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The Fellows Gear Shaper.

The accompanying illustrations show a new machine for cutting gears, and not only a new machine, but a new system as well. The curves of both cutter and gear teeth are generated curves, and under a system which obviates many of the errors which are incidental to the usual process. Thus there is no hand work whatever, no templates to be made or copied, and no error due to the hardening of the cutters or to the use of a cutter through a range of sizes, to only one of which it is exactly adapted. The cutter curves are generated in one machine, and the gears are cut in another, the perfection of the work being limited only by the degree of perfection of these machines.

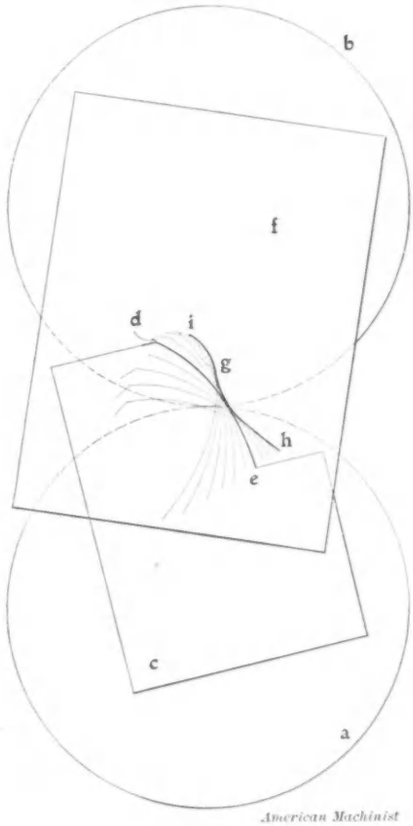


Fig. 1

GENERATION OF A TOOTH PROFILE.

The principle at the base of the system will be clear from Fig. 1, which shows a simple model made for this purpose, and illustrates how a tooth curve may be determined to mesh properly with an existing gear. The circles *a* and *b* represent two rollers of wood whose diameters are equal to the pitch circles. A piece of cardboard *c* is tacked to the lower roller, and has its edge *d e* cut to the profile of the existing curve. A second piece of card *f* is tacked to the upper roller and plays freely below the piece *c*—the latter being represented as though transparent, in order to show the curves. If the two disks be rolled upon one another, and successive outlines of the tooth curve *d e* be drawn, they will appear as shown, and if to these curves a common tangent curve *g h* be drawn, it will give the proper curve to mate with *d e*. This simple model is an extremely instructive one, and will well repay the making by any of our readers. Among other things, it will make plain what is, to many, obscure—the reason and origin of the clearance curves at the roots of the teeth. This curve is here exaggerated and occupies the position *g i*. It is not properly a continuation of the tooth profile *g h*, but, on the contrary, is traced by the point *d* of the generating tooth. It is obvious at once that if the cardboard *c* were a cutting tool with the outline *d e* reciprocating perpendicularly to the paper, with the rolling action going on at the same time, it would cut the piece *f* to the profile *i g h*, and it is in this manner that the Fellows machine cuts the gear teeth. As shown, however, in Fig. 1, the existence of the tooth curve *d e* is presupposed, whereas in practice it is necessary to obtain it. This is done on the same essential principle, except that the roller *a*, with its curved tooth profile *d e*, is replaced by a rack, or its representative. On the involute system the profile of a rack tooth is a straight line, which is easy to originate, and hence forms the starting point of the system. The system will thus be seen to comprise two machines. The first starts with a single straight tooth rack representative, which is, in fact, an emery wheel, past which the hardened cutter blank is rolled and its teeth ground to shape. This cutter is then placed in the second or gear-cutting machine where the cutter and blank are rolled together while the former reciprocates, and thus the gear tooth profiles are generated.

The machine for forming the cutters will, of course, be found in the works of the makers only, as the plan contemplates the furnishing of the cutters to the trade as is now done with milling cutters. Its mode of action will be seen from Fig. 2, which is a sectional diagram. The original rack tooth forming the starting point of the system is represented by the side of the emery wheel, which is dressed off to correct flatness and position by a mechanically guided diamond tool. The imaginary rack, of which it represents one tooth, is shown in dotted lines, the cutter blank to be ground being shown in two of the positions assumed while it is guided and rolled past the emery wheel in true rack and pinion motion. The teeth are ground on one side, one at a time, and stepped from tooth to tooth, until the circle is completed, when the wheel is reversed,

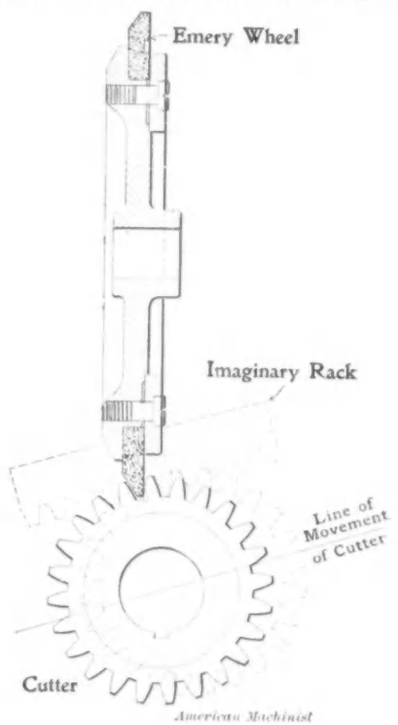


Fig. 2

GENERATION OF CUTTER TEETH.

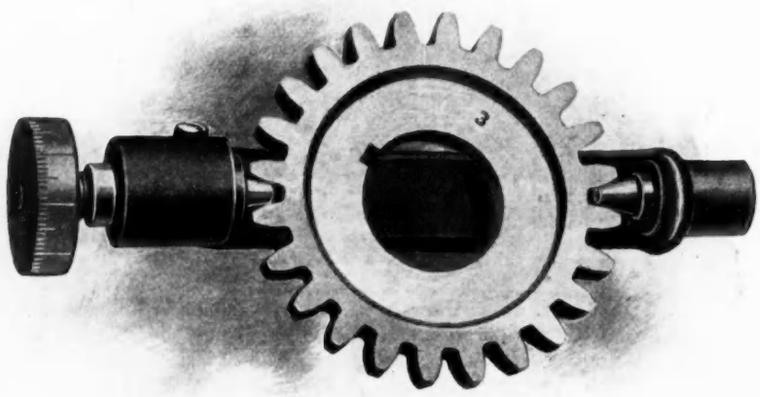


Fig. 3. CUTTER AND MICROMETER.

and the opposite sides are ground in the same way. This final shaping of the cutters is done after they are hardened and when flooded with water. It will be understood that the acting face of the emery wheel is the radial face, the beveled edge being of clearance size, and that the cutters are roughed out by milling before being hardened. It will be seen that the angle of obliquity is determined by the direction of movement of the cutter center in relation to the emery wheel face.

The cutter thus formed is a generating cutter, which does not reproduce its own shape of teeth except in a gear of its own size. The one cutter is used for all gears of the same pitch, whatever may be the size. Fig. 3 is from a photograph, and shows the completed cutter together with a special micrometer caliper, the use of which will be described later.

The action of the cutter on the gear is shown in Figs. 4 and 5, which are sectional elevation and plan, respectively. The cutter is mounted on a revolving spindle, the projecting end collar of which will be seen at *a*. This spindle is in turn carried by the reciprocating shaper-ram, *b*. The bank of gear blanks to be cut will be seen mounted upon the arbor, *c*. An adjustable work support will be seen at *d*. In operation the cutter is reciprocated vertically, while at the same time the cutter and the blank are slowly rotated together, at an equal pitch line speed, presenting fresh metal to the cutter at each stroke, this motion being continued until the blank has made a complete revolution. When a fresh blank is introduced, the first feeding motion causes it to approach the cutter until the proper depth of tooth is reached, when this feed stops and the indexing feed is thrown in, both these actions being automatic. The indexing feed is by two connected worms, one of which turns the blank, while the other turns the cutter, precisely as though they were finished gears driving one another. This motion, going on while the cutter is reciprocating, results in generated gear teeth which mesh properly with the cutter and with one another. The plan view, Fig. 5, shows this action more clearly. When the cut was begun space *a* was on the center line, and after the depth feed was completed the index feed rolled cutter and blank together, this action being continued for the arc shown. The imperfect tooth at the beginning of the cut will be completed when the revolution is completed.

Fig. 6 is from a photograph, and shows the appearance of the completed machine. The main driving cone will be seen in the

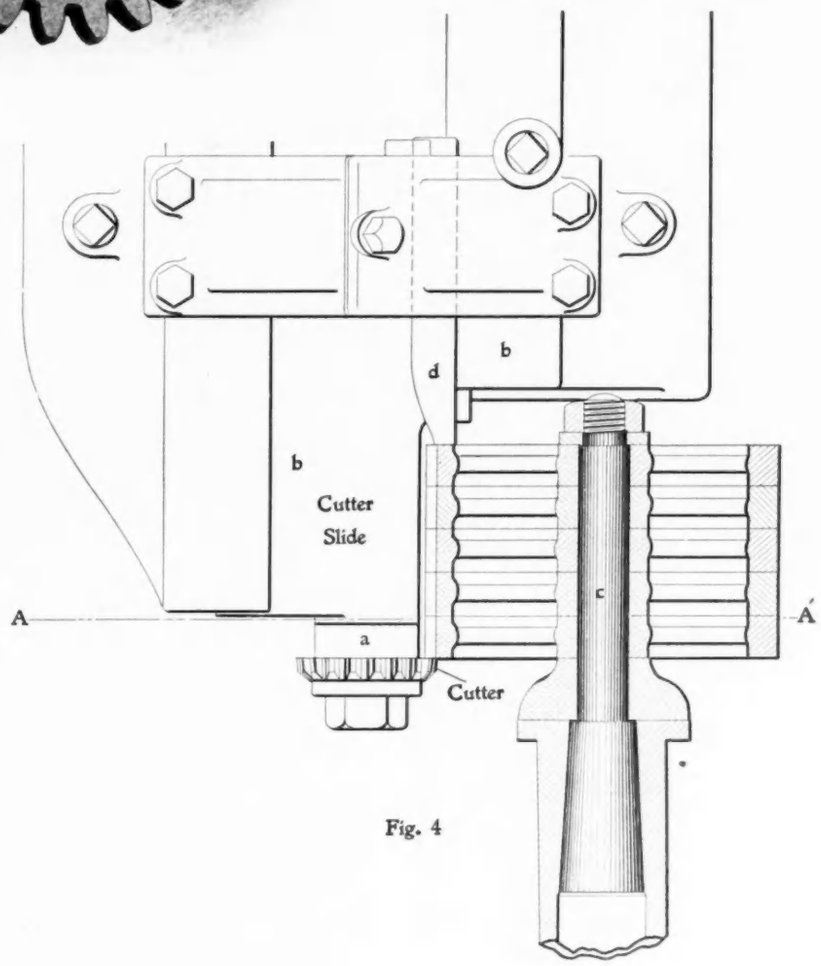
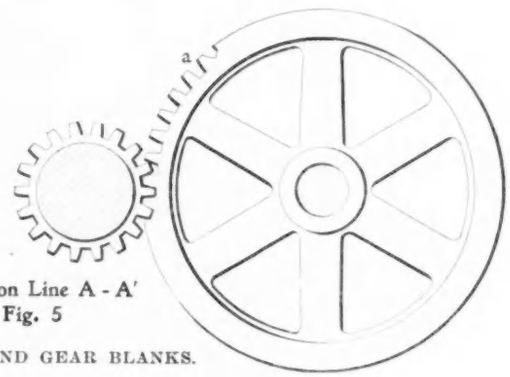


Fig. 4



Section on Line A - A'
Fig. 5

CUTTER HEAD AND GEAR BLANKS.

rear, from which a smaller cone drives the one shown on the small horizontal shaft at the top of the machine. A worm upon this shaft drives the worm wheel shown on the cutter spindle. A pair of helical gears at the right of the small cone pulley drives the vertical shaft which runs down to the nest of gears below and to the right, through which the blank driving worm and arbor are driven, this worm wheel being concealed in the picture by a protecting shield. The worm wheel and arbor are mounted on an apron, which swings outwardly for the insertion and removal of the work, and which reciprocates horizontally through a short distance in order to clear the cutter teeth on the return stroke. The vertical reciprocation of the ram and cutter is accomplished by the splined rock shaft within the horizontal cross-rail, which drives the ram by a helical rack and pinion, and is driven at its right-hand end from the main driving shaft. The screw seen within the cross-rail is for the adjustment of the cutter and the depth feed. When inserting the first blank of a given pitch, the pilot wheel at the right is adjusted by a scale upon it to the pitch to be cut. A sheet-metal gage is then inserted between the blank and the cutter, and the cutter is brought up to contact with the gage by the crank seen on the cutter ram guide, which crank acts to turn the sleeve nut engaging with the long screw. When adjusted, the handle at the right of the crank binds the nut in position, and the machine is started.

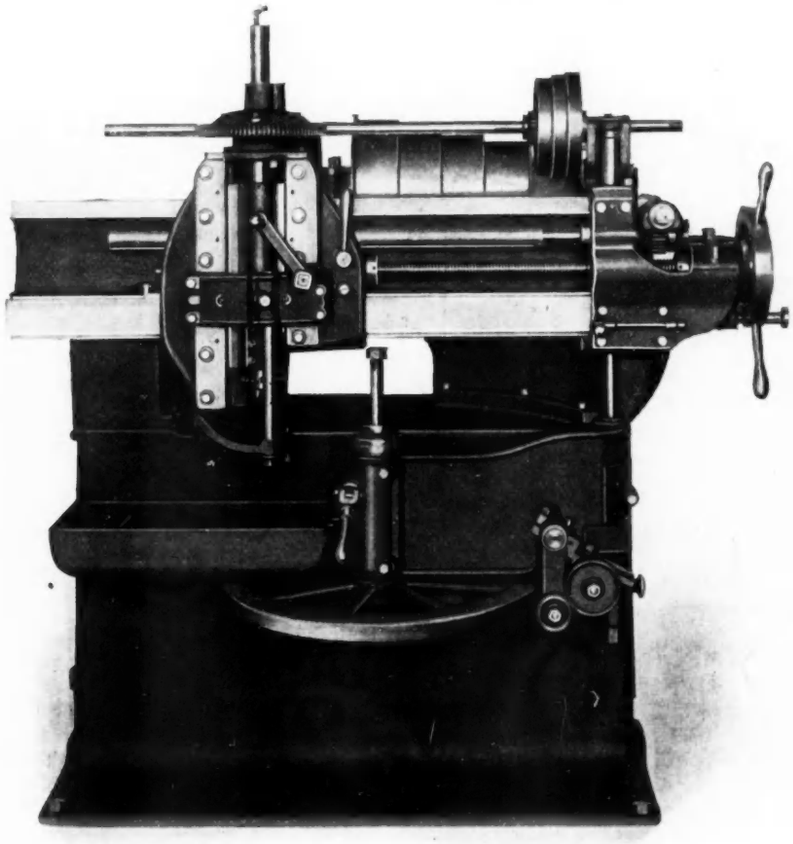


Fig. 6. THE FELLOWS GEAR SHAPING MACHINE.

The first action is to feed the cutter to the proper depth. When this is reached the depth feed is disengaged and the indexing feed engaged automatically, and the work proceeds until the gear is finished, when the machine stops and a bell rings. The machine will thus be seen to comprise three movements—one giving a reciprocating motion to the cutter, one relieving the cutter from control with the work during return stroke, and one feeding the cutter and work slowly in unison.

The machine can be used with either a drawing or a pushing cut. The former is preferred, and is used, except in a few cases. The drawing cut requires a substantial nut below the cutter, for which there is not always room. In the case of a small pinion, such a nut would interfere with the gear arbor collar, and again, in the case of an internal gear, such a nut would interfere with the arms. In all ordinary cases, however, there is no interference, and the drawing stroke may be used without difficulty. Fig. 4 shows the cutter set for a drawing stroke, while Figs. 6 and 7 show it arranged for a pushing stroke. The only other change necessary in this connection is in the short clearing stroke of the work apron, which, of course, requires to be on the return stroke, whichever that may be.

The remark above will indicate that in-

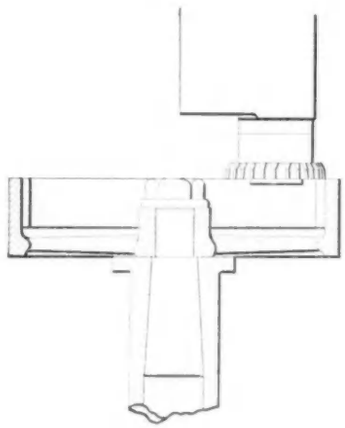


Fig. 7

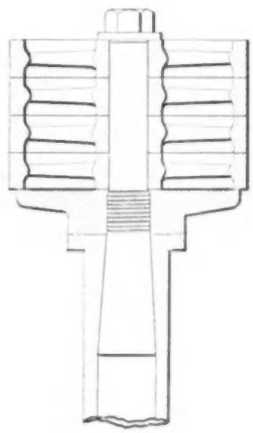


Fig. 13

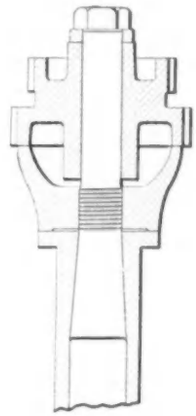


Fig. 10

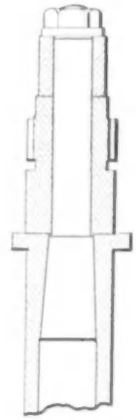
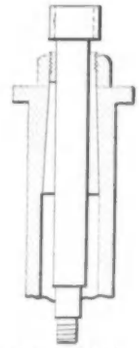


Fig. 11



American Machinist

Fig. 12

SPECIAL APPLICATIONS OF THE SYSTEM.

ternal gears may be cut with the machine, and the manner of doing this will be apparent from Fig. 7, from which it will be seen that if the gear is large enough to take the cutter between the rim and the hub, the internal form offers no difficulty. Fig. 8 shows a gear which is both internal and external, and which was cut on the machine. It is, in fact, the back gear of the machine, and is sufficiently novel as a back gear construction to deserve further description. Its arrangement will be seen in Fig. 9, in which *a* is the driving and *b* the driven shaft, the latter being mounted in an eccentric quill. In the position shown, pinion *c* drives shaft *b* through the internal gear *f*, the pinion *d* running idly; but it is clear that the throwing over of the quill will disengage *c* from the internal gear and engage *d* with *e*, thereby increasing the speed in the ratio of *f* to *e*. The office of *d* will be seen to preserve the direction of motion of *b* constant for both speeds.

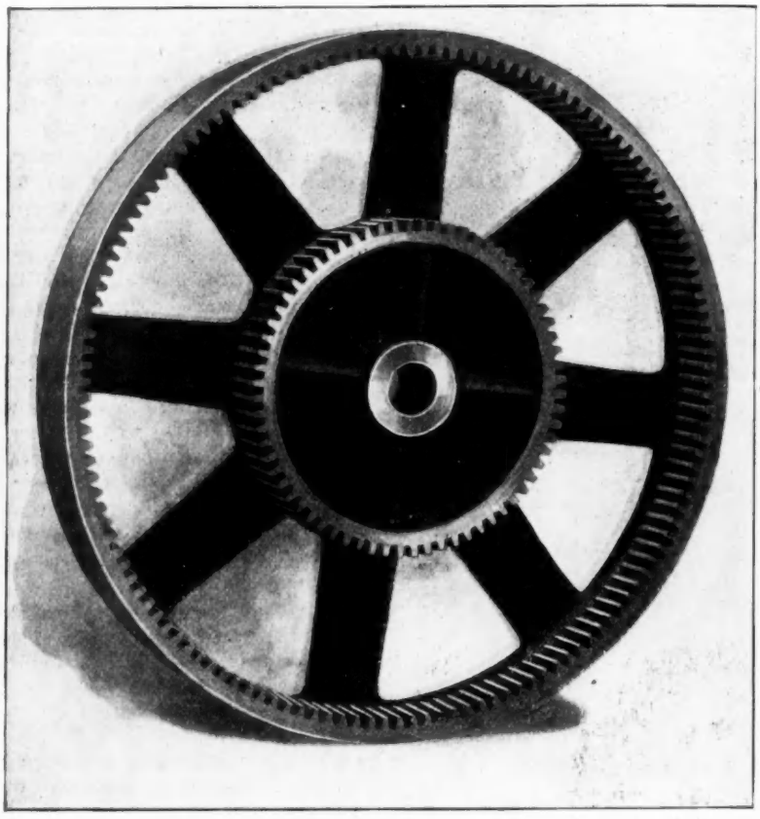


Fig. 8. A CUT INTERNAL GEAR.

Other jobs which could scarcely be done with a milling cutter, but which offer no difficulty with this form, will be seen in Figs. 10 and 11. Fig. 12 shows a method of holding small pinions which are in one with their shafts by a collet chuck, and Fig. 13 shows a method of giving additional rigidity to the gear blanks. In Figs. 4, 7, 10, 11, 12 and 13, it will be seen that the work arbor is drawn against a taper seat within the indexing spindle by the nut which secures the work in place, thus binding work, arbor, supporting washer and spindle firmly together.

A natural criticism of the system would be that the indexing worms on which the accuracy of the work depends are constantly at work under pressure, and hence might be expected to be subject to rapid wear. To test this, gears have been cut with the gear blank free on its arbor, with the result that the cutter itself indexed the work with an error of less than a quarter of the pitch for the entire revolution.

A feature of the system by which the correct diameter of the cutters is obtained remains to be described. The correct profiles of the cutters are obtained as has already been explained in connection with Fig. 2, but the machine on which this is done provides no means of correctly determining the diameters. This is done by means of the micrometer already shown in Fig. 3. In the first instance, a cutter of given pitch is made by trial, but with the teeth too thick, rather than too thin. Two gears are then cut with it, the teeth of which are of course too thin. These gears are then placed in mesh, and the center distance is measured, which is of course too small. The cutter is then reground, and additional trial gears are cut until the center distance comes right. This cutter is then preserved as a master cutter, and future ones are made to agree with it by the micrometer shown in Fig. 3. This micrometer has its contact points made of the rack tooth profile, and these points bottom on the sides of the teeth as a rack tooth would do. The pitch of the screw and the graduations of the head are so proportional to the angle of the contact points, that the readings, referred to the thickness of the space at the pitch line, are in ten thousandths of an inch.

There are a number of curious and interesting side issues growing out of this system of gear cutting, one of which is shown in Fig. 14. The left-hand gear of

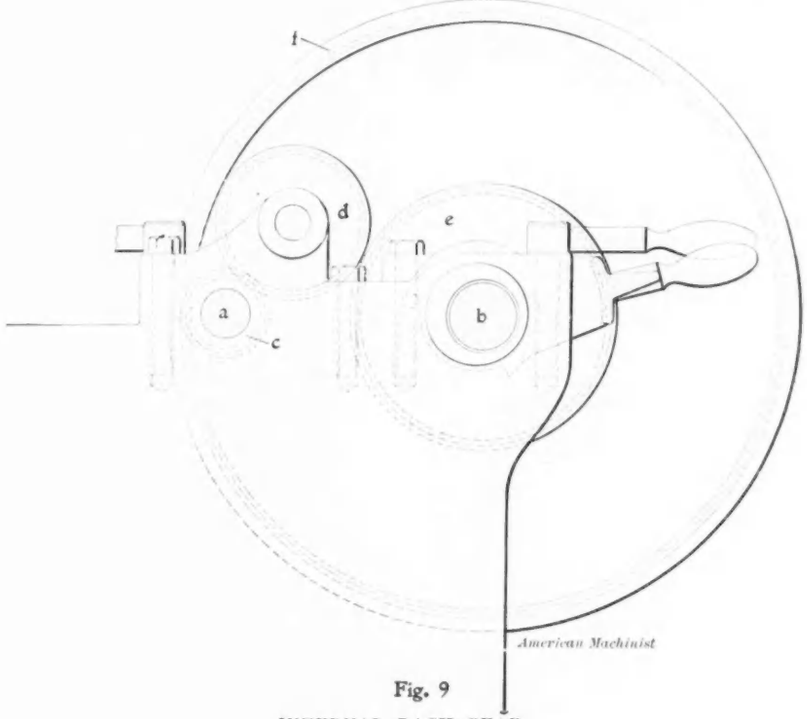


Fig. 9
INTERNAL BACK GEAR.

this set is a correctly cut gear of twenty-four teeth. The middle one is of the proper outside diameter for twenty-six, and the right hand for twenty-three teeth, but both the latter were put in the machine without change of the index mechanism from the arrangement used for the first gear, and, consequently, both have

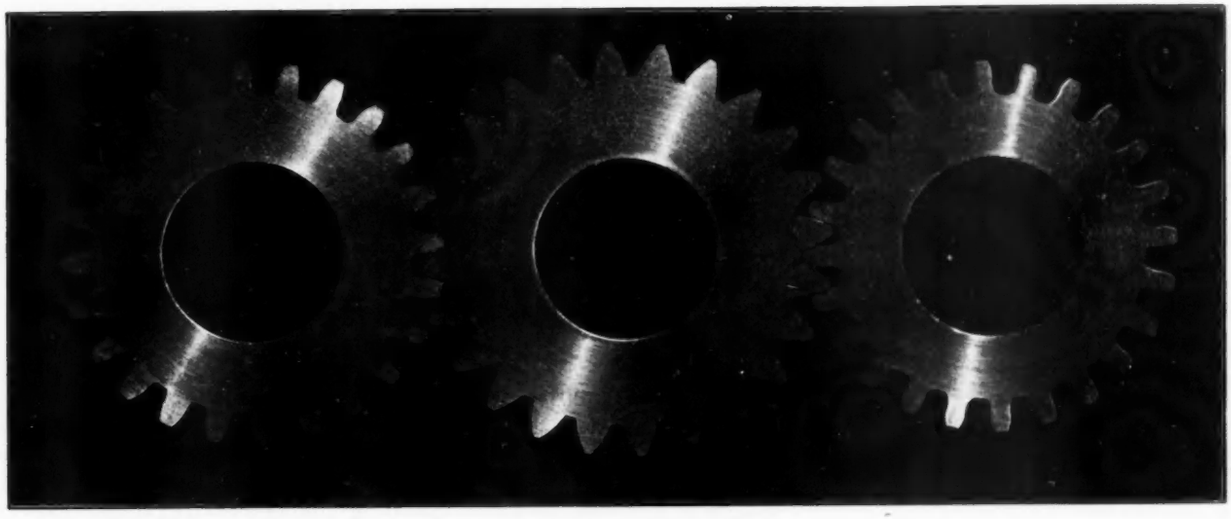


Fig. 14. ABNORMAL TOOTH CURVES.

twenty-four teeth. Were this plan followed with milling cutters, the result would be the same tooth outline as in the normal case, but at a different distance from the center. The spaces would be the same in all cases, but the teeth would be too thick in one case and too thin in the other. With the present case all this is changed. The curves being generated curves, they are correct in all cases, and from the principle of the system all must gear correctly together, as, in fact, they do. This results in gears of different diameters, running at the same speed, which at first sight is self-contradictory. It is an illustration of excessive addendum in one case, and of excessive dedendum in the other. In gears of the usual proportions, the projection of the teeth beyond the pitch line is equal to depth of the cut below it, with an allowance for clearance. There is, however, no absolute necessity for this construction, and the present case illustrates this fact. Fig. 15 shows a tooth curve in which the pitch line is at *a b*, the portion of the tooth curve ordinarily used being *c d*, which is divided in halves by the pitch line. In the case of the largest gear, of Fig. 14, the portion of the curve used is *e f*, and in the case of the smallest, *g h*, the pitch circles being the same in all.

Those who recall Hugo Bilgram's exhibit of gear wheels at Chicago will remember a feature of it which is interesting in this connection, and those who care to do so may refer to our issue of October 12, 1893, where they will find an interesting explanation, by Mr. Bilgram, of the principle involved, and engravings of a bevel gear with which three bevel pinions of varying sizes are made to work properly.

What appear to be concave flanks of the teeth of the smallest gear are not, in fact, flanks at all, but clearance curves already shown in Fig. 1, whose magnified importance is due to the cutter teeth projecting so far within the base circle. Mr. Fellows considers that these gears illustrate the correct method of making pinions with few teeth. Such pinions with, for example, twelve teeth, are weak in form when cut in the usual manner, which defect can be overcome by this method. In making a twelve-tooth pinion Mr. Fellows would turn the blank for, say, thirteen teeth, and then index

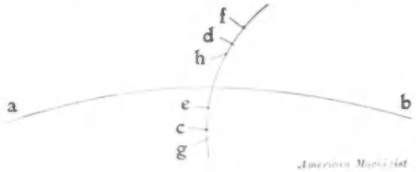


Fig. 15

EXCESSIVE ADDENDUM AND DEDENDUM.

the machine for twelve, the result being a tooth with spreading base like those of the middle gear of Fig. 14. If the gears of Fig. 14 be placed on top of one another, the tooth profiles show themselves to be continuations of the same curve.

This system has been developed with the idea of producing the best possible teeth, and its claims to recognition are based on the accuracy of the results. Nevertheless, and contrary to what might be at first expected, its speed of execution has been found to be highly satisfactory. Experience with it is not yet sufficient to determine what the ultimate capacity will be; but the results so far obtained indicate that the speed will not be less and may be greater than with the milling process. This is contrary to what would be expected of a planing process, but there are several points wherein the natural disadvantages of a planing process are overcome. Thus with a milling cutter the tool must overrun the work on both sides, which, with gears of average face, involves a considerable percentage of surplus travel. With the planing process this surplus is cut down to a trifling amount. Again, these cutters have a proper degree of top rake, which milling cutters, of course, do not. In point of fact, the chips from this machine curl like lathe chips, and resemble them more than they do milling chips. Another feature favorable to hard work is the drawing stroke in connection with the work support shown in Fig. 4, which practically confines the cutting strains to the ram head and its guide, which is obviously favorable to rigidity; or, in other words, permits heavy cutting without undue springing of parts.

The machine is the invention and design of Mr. E. R. Fellows, and is controlled by the Fellows Gear Shaper Company, of Springfield, Vt.

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What Puzzled the "Eminent Physicists."

"Sir: A group of half a dozen physicists, all eminent; a sheet of paper; a pencil. With the latter one of the group draws a pulley, a cord over the pulley, a tree, a bough from which the pulley hangs. To one end of the cord is attached a stone; to the other cord clings a monkey. The stone balances the monkey. If the monkey proceeds to climb up the rope, what will happen? Will the stone rise or fall? Heated discussion; break up of the party; no result. Can any of your readers help to settle this question?

ALFRED JINGLE.

"Dingley Dell, November 9th."

—"Engineer."

We confess we can see little room for discussion, as to whether the stone will rise or fall; but precisely just what will happen to the monkey may be a question that is a little more complicated.

Antiquated Tools.

The following letter is from a recent issue of "The Practical Engineer," London:

"Sir: I should like to call your attention to the disadvantages under which our workmen of the engineer branch of the Royal Navy have to work in the matter of tools.

"I do not think there is a self-centering chuck of any description upon any of our ships; the drill chucks they have are those which are condemned in a private shop by the factory inspector, viz., those with a projecting set screw. The gentlemen engineers seem to have forgotten the existence of the twist drill, for the workmen never see anything but the flat forged drill, which takes as many hours as it should do minutes in the case of a long hole; they still serve out the old back saws. It is enough to turn one gray to use it after the American star blades. Is it because the improvements are American, or because the engineers (?) have never worked with them, that they do not adopt them in the Royal Navy?

"Yours, etc.,

A MODERN WORKMAN.

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Letters from Practical Men.

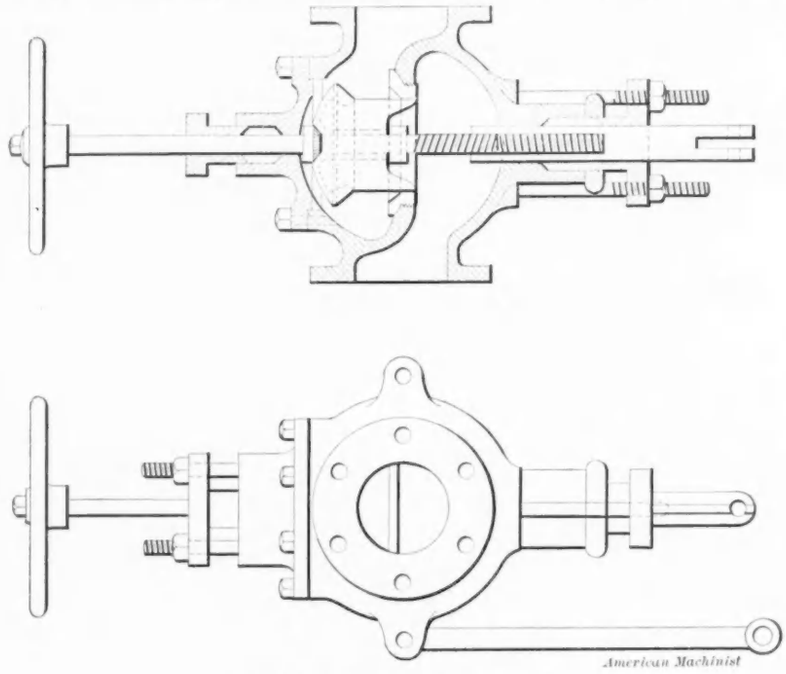
A Safety Throttle Valve.

Editor American Machinist :

A short time ago I saw an editorial in your paper touching on the several bad accidents during the last few years from runaway stationary engines whose fly-wheels have burst, often with fatal results. It was said that many lives have been lost simply on account of the throttle valve wheels being on the same side of the engine with the fly-wheels. In many makes of engines it is necessary to have it on that side for convenience in stopping and starting. To meet these conditions I have designed a valve, of which I send you a sketch, with a means of closing it quickly from the side opposite the fly-wheel in case of emergency. The valve stem turns loosely in the valve, being made steam tight by a grand collar fitting on top of the valve. The end of the valve stem screws into a sliding plunger that is worked by a lever not shown. The lever is kept dropped in a notch, and need not be used except in case of accident, but is always ready.

F. W. SALMON.

Burlington, Ia.



A SAFETY THROTTLE VALVE.

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The Air Cushion for Elevators.

Editor American Machinist:

The omniscience with which editors are credited must sometimes be embarrassing. It must be so hard to keep it up, and it must be so certain that it cannot always be kept up. Somebody must know about something even more than an editor can know about everything. If, for instance, a builder of elevators did not know more about elevators than the editor who has to keep in view the whole field of mechanical knowledge and activity, then he certainly could not be a fit one to be entrusted with the designing or building of elevators.

The American Machinist" seems to have a happy faculty of getting people who know special things to write about the things that they know. I suppose various inducements are offered to draw them out, and sometimes, probably, the inducement is more in the shape of a provocative. I don't know why that way is not as good as any other, if we all get some good out of it. I notice that an editorial of the "American Machinist" has provoked Mr. Bryan, an elevator man, to say something about elevators. What he says is generally interesting and instructive, but I must confess that I was a little surprised at what he said about the safety of the air cushion.

My attention was called to this device a great many years ago. I happened to know, personally, Mr. Jones, who was killed in Boston in an attempt to demonstrate the value of the air cushion for elevators. Jones was a good fellow, but he was, unfortunately, one of those men who are born without the mechanical instinct. He properly should never have assumed, or have been allowed to assume, any risk or responsibility in connection with anything mechanical. His death was a natural consequence of his association with mechanical devices. The air cushion that he built for his destruction was of brick, just a plain chamber with a light brick wall, and practically nothing outside the wall to enable it to resist the pressure. Jones got into the elevator carriage when it was hauled clear up, cut the rope, and dropped; the bricks flew in every direction, and the man was killed. As soon as the carriage began to compress the air a little, there was no air cushion there.

Experiments are not always conclusive either for or against a thing. Some other fellow is so apt to come along with a different experiment. There is one class of experiments that is peculiar. Mr. Bryan says: "Some years ago I made a series of tests upon air cushions to demonstrate this fact" [that air cushions were no good], "and found the conditions and actions of the air cushion to be just as described." Experiments made to demonstrate previously assumed facts have quite a habit of succeeding.

Mr. Bryan says that in the very worst elevator drop—that is, with a big load from the top—the air cushion works beautifully, that it "will stop the car quite as well as we could wish for." But if the car fall a shorter distance, or with a lighter load, the air cushion is "likely to send it flying back up the hatchway, and the subsequent fall is disastrous." That is one of the strangest things I ever heard of. Why would you not have a more disastrous rebound in the first instance with the greater momentum in the drop?

Why should there ever be any rebound in either case? If a fellow was competent to design an air cushion for an elevator, could he be ignorant of the fact, could he for a moment ignore the fact, that there must necessarily be a rebound? Would it not naturally be his first thought and his first business to guard against and prevent the possibility of a rebound? I can scarcely imagine a respectable mechanical problem any simpler. It might be done by ratchet teeth or by friction, or the air pressure itself might be made to apply

a clamp which would effectually prevent rebound. Mr. Bryan's experiments should have been directed to the simple demonstration, not of how a carriage can and will be made to rebound, but how it might be prevented from rebounding. I do not know much about the present status of the air cushion for elevators, but I must hear of some better foundation for an objection to them than is found in the fact that air is elastic, and Mr. Bryan does not suggest any other. I suppose there is an objection that has considerable influence, and that is that an air cushion must be somewhat expensive and requires some additional space; but it is still entitled to respectful consideration until something surer and better is at least suggested.

TECUMSEH SWIFT.

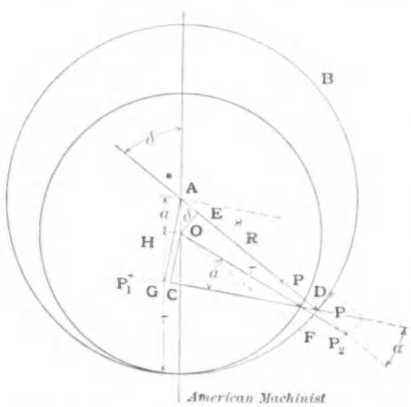
▲ ▲ ▲

The Almond Engine.

Editor American Machinist:

Referring to your description of the Almond engine, and to your statement that "there seems to be no possibility of reversing the engine by any change of port arrangement, or otherwise," I judge that your understanding of the question is, that if, in Fig. 5, cylinder B were open to steam and cylinder D to exhaust, the engine would refuse to run in the direction opposite to that of the arrow.

In reply to that, it is sufficient to say that in any machine the power transmitted or delivered (friction neglected) is always measured by the velocity of the point of application, both as to amount and as to algebraic sign. Therefore, since during revolution opposite to the arrow the shoe of cylinder B (or the surface under it



which takes the thrust of the steam pressure acting against the head of B) separates from this head, than any force, such as the expansive power of the steam, which tends to separate these surfaces *must* develop positive work in the rotation of the system in that direction, or "astern."

Now it may be that such work is not sufficient to overcome the friction resultant from oblique action of the forces. To ascertain this point, let us analyse a bit.

Let O be the center of the shaft, and B be the circular path of the knuckle-joints about A as a center. Let d = the eccentricity, and R and r the respective radii. Let $C\,D$ be the center line of cylinder B (your Fig. 5).

If steam be admitted to cylinder B (in your diagram), the cylinder will be forced to the left by a force P, and the piston to the right by the force P. But the shoe is crowded in the direction of $R\,A$ by an equal force P. This latter force can be considered as divided into two portions—one P^2 ($= P \cos.\ j$, where j is the angle made by $C\,D$ with the radius of eccentricity $A\,D$ to the point D), which balances the radial component of the piston-thrust upon the knuckle-joint; and the remainder, $P\ (1 - \cos.\ j)$, which is unbalanced, except by centrifugal force or friction. This leaves to be yet enumerated the tangential component of the piston-thrust at D, which is equal to $P \sin.\ j$, and which is also unbalanced.

If we consider rotation counter clock-wise to be positive, for the moment, the net effect of these three unbalanced forces tending to produce rotation is the algebraic sum of their moments about O as a center, or $M = P \sin.\ j\ .\ O\,F + P\ (1 - \cos.\ j)\ .\ O\,E - P_1\ .\ O\,C$. Substituting the geometric values of the moment-arms in terms of known quantities, we have:

$$
\begin{aligned}
M &= P \sin. j\,(R - d\cos.\delta) + P(1 - \cos. j)\, d \sin.\delta - P\, r \sin.\alpha\,; \\
&= P[R \sin. j - d \sin. j \cos.\delta + d(1 \cos. j) \sin.\delta - r \sin.\alpha]\,; \\
&= P[r \sin.\alpha + d\cos.(90 - j - \delta) - d \sin. j \cos.\delta + d(1 - \cos. j) \sin.\delta - r \sin.\alpha]\,; \\
&= P\,d\,[\sin.(j + \delta) - \sin. j \cos.\delta + (1 - \cos. j) \sin.\delta]\,; \\
&= P\,d\,[\cos. j \sin.\delta + (1 - \cos. j) \sin.\delta] = P\,d \sin.\delta.
\end{aligned}
$$

In other words, the moment is positive as long as δ lies between 0 and 180 degrees, and is negative when δ lies between 180 and 360 degrees; or, any force tending to separate shoe and cylinder-head while the knuckle-joint lies to the right of the center line, tends to produce rotation counter clock-wise, while to the left of the center line rotation clock-wise.

Further, this tendency is the same as that in an ordinary crank engine having a stroke of 2d and a connecting rod of infinite length, or having a yoke-and-sliding-cross-block connection.

Further, the force producing rotation is entirely independent of the angle α at which the cylinders are inclined to the radius through D, and is independent of the radii R and r; it depends solely upon the steam pressure P, the eccentricity d and the position in rotation at the instant of consideration.

As to friction, the force pinning the shoe to the casing is less in counter clock-wise than in clock-wise rotation; for it is the centrifugal force less $P\ (1 - \cos.\ j)$, and j is greater in the right-hand semicircle. The force tending to "cock" the piston in the cylinder is greater in the right-hand semicircle, but is always small, being something less than $P\ (1 - \cos.\ j)$. So rotation in either direction ought to develop friction about equally.

The argument given in the second paragraph of this letter is just as adequate to prove the question before the house—as to direction of rotation—as is all this long analysis. It is also just as adequate as to total power developed, although not giving the exact torque at any given angle. The whole thing is an excellent illustration of the value of being able to "think straight through" a problem to its further side, by means of general principles, rather than being confused and distracted by a complex array of individual forces, or being misled by a consideration of only the most obvious ones. It is this faculty of "knowing how to think" which educational institutions chiefly strive to cultivate; which, in fact, is the only thing that constitutes an education.

SIDNEY A. REEVE.

[Perhaps a still more simple way of arriving at a correct conclusion in this matter is to consider that in order to do any work, or to produce any motion whatever, the piston which produces the motion must be forced outwards from the cylinder head. Otherwise there can be no consumption of steam and no work done. The only way that steam can be consumed in giving motion to the engine under the conditions stated by Mr. Reeve, is by turning the engine in the direction opposite to the arrow. If it turned with the arrow, the space between cylinder head and piston B would contract, or, in other words, we should be doing work by forcing steam out of the cylinder back into the boiler, which, of course, is absurd, and the statement in the description referred to by Mr. Reeve is manifestly wrong.—Ed.]

▲ ▲ ▲

White Lead vs. Graphite as a Lubricant.

Editor American Machinist:

In the "American Machinist" of November 11th, among "Letters from Practical Men," we find a letter from Mr. Renwerk, who advocates the use of white lead in preference to graphite as a lubricating agent, or, as he would state it, to fill up the irregularities of the bearings. In the beginning of his letter, Mr. Renwerk says:

"On examining under a magnifying glass the finished surfaces of a locomotive crosshead gib and guide, both in profile, I was surprised to find they showed surfaces similar to the face of a coarse bastard file as seen with the naked eye."

Prof. Denton, Prof. Stillman, Prof. Thurston and many others have demon-

strated that friction is the resistance of the microscopic irregularities of surface to removal, and the heat engendered represents the work done in overcoming this resistance.

To prevent this waste of energy and the wear of material which it represents, to say nothing of delays and annoyance, science and common-sense have united in discovering and perfecting a number of substances which, when introduced between two rubbing surfaces, fill the microscopic irregularities, and so lessen the amount of friction, if they do not fully overcome it.

An oil lubricant, by filling up the inequalities of the bearing surfaces with its globules, lifts the opposing surfaces above the irregularities and forms a new surface, consisting practically of an innumerable series of microscopic but perfect "ball bearings," and through their intervention the friction of solid bodies is exchanged for a fluid friction, as explained by Crossman, who says:

"Different parts of the same lubricating layer, moving at different speeds, produce relative movements, which result in friction in the lubricant itself. Movement of the solid surfaces over the slower-moving fluid particles, produces friction between the solid and the liquid bodies, and consequently the friction resistance of well-lubricated solid bodies consists of the sum of the frictional resistance between the fluid and the solid bodies and between the particles of the fluid itself."

White lead, graphite, mica and various substances have been tested by all experts on friction, and they have all agreed, without any question, that pure flake graphite is, by all odds, the best material for filling up the irregularities mentioned and for making the nearest to an ideal bearing that can be obtained. Graphite has a very strong affinity for metal surfaces, and therefore adheres easily to the metallic bearings. It is quite probable that Mr. Renwerk uses it in too large quantities, hence the bad result.

One drawback to the use of graphite, heretofore, has been the fact that impure graphite is not readily detected. Some of the impure graphite looks, so far as the eye can detect, exactly the same as the purest. For this reason, graphite should be obtained only from some reputable manufacturer who will guarantee the product to be pure.

If Mr. Renwerk will kindly send us his address, we shall be most happy to send him some literature on the subject of graphite lubrication which we think will satisfy him that graphite is far superior to white lead as a lubricant, providing he is willing to take as his authorities the names of well-known experts on friction and the statements of hundreds of practical locomotive engineers.

JOS. DIXON CRUCIBLE CO.,
Jersey City, N. J.

A Job for the Shaper.

Editor American Machinist:

Some time ago the company that I was with had a contract for a number of drop-hammer anvils and the shears or guides that carry the hammer. These blocks weighed about 8 tons each, and were about the proportions shown at *A*, in Figs. 1 and 2, the latter being a plan view.

The machine work on these castings consisted of planing off the top and planing the bottom and sides of the gap *G*, which was designed to hold the dies. The pockets *F* were planed on the sides *h*, the ends being left rough. It was necessary that the sides of these pockets be square with the top, so that the tennon on the bottom of the shears would fit properly. As we had no slotter, we devised the way I am to describe.

A large angle plate, shown at *I*, in Fig. 1, was made, and a 15-inch Gould & Eberhardt shaper was taken apart at the joint in the column, and the whole erected as shown in elevation in Fig. 1; the saddle of the shaper being bolted fast to the angle plate, and the regular feed used to take the cut; only, instead of the feed moving the saddle and the work in the ordinary manner, the saddle, being anchored to the massive casting, remained stationary, and the shaper moved along on the angle plate to give the feed. This made necessary the use of a drum overhead for driving, instead of the usual pulley, and we made this drum of sufficient length, so that it took care of the belt when the change was made from one pocket to the other.

A double-ended tool was put in a long tool-post, which was threaded on the outside, and a collar screwed against the tool. A similar collar screwed against the tool-post block held the tool-post fast. When one pocket was finished, the shaper was loosened, moved along on the angle plate, and the other pocket planed out. The work was done with all necessary accuracy, and also done expeditionsly.

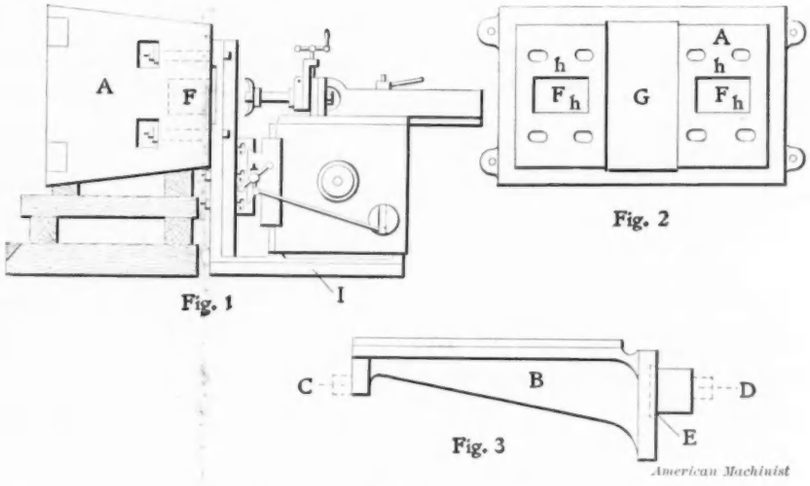


Fig. 1 Fig. 2

Fig. 3

A JOB OF SHAPER WORK.

B, in Fig. 3, is a side view of one of the shears, both members of the pair being the same. The top edge was planed to fit a V-shaped groove in the hammer, and it was necessary that the shears should be as near parallel as possible, and should be practically square with the base. And it is what we did not do, rather than what was done, that I want to comment upon. Centers were drilled on the line *C D*, and the casting swung up in the lathe and the bottom faced off. Then a pair of tail-stocks from two 48-inch lathes were bolted down on the planer platen, and the V-shaped edge and the sides of the tennon planed. The difficulty with this was that it was a painfully long task to get the centers in line every way, and when that was accomplished, it made an exceedingly unreliable combination. The work was finally done in an acceptable manner, but no one felt very proud of it.

Now, if there had been a trunnion cast on each end, as shown in dotted lines in Fig. 3, at *C* and *D*, and these had been turned up to the same size at the time the bottom was faced off, V-shaped blocks could have been used on the planer instead of centers. The V-shaped blocks could have been secured in their proper places and the notches planed out, and a good job done with little or no hard work.

A circular cavity *E*, shown by a dotted line, could have been cored around the tennon, so that all of the bottom could have been finished in the lathe, and the strength of the casting would not have been impaired a particle. As it was, the bottom had to be partly finished in the planer, which necessitated setting the casting four times, and as it weighed about 1,600 pounds, and was 7 or 8 feet long, it was no soft snap. All of this is very simple, of course; but it is more forcibly apparent now than it was before the job was started.

A. L. BOWEN.

Harvey, Ill.

Charles Wallace Hunt, President-Elect of the American Society of Mechanical Engineers.

Following our established practice, we take pleasure in presenting to our readers a portrait of the president-elect of the American Society of Mechanical Engineers. Mr. Hunt was born in Candor, Tioga County, N. Y., in 1841. He was educated at Cortland Academy, Homer, N. Y., afterwards receiving some instruction in mechanics and the higher mathematics from a private tutor. In the year when Mr. Hunt attained his majority he entered the military service of the government, serving mostly in Virginia from 1862 to 1865. For several years after leaving the army Mr. Hunt was in quite delicate health, in consequence of exposure and hardships in the field. No trace of this experience is found in Mr. Hunt's present appearance.

C. W. HUNT,
President-elect of the American Society of Mechanical Engineers.

Mr. Hunt quite naturally fell into mechanical lines, and after a few years of general experience, commenced the manufacture of machinery for handling materials on Staten Island, N. Y., in 1872. The business has grown continually, until it has reached its present proportions and world-wide reach. The firm now puts out a great variety of devices, and it is the boast of Mr. Hunt that his products have actually been designed and developed for the purpose of filling well-known and previously defined and appreciated wants.

They were none of them first invented and the use hunted up afterward. A son of Mr. Hunt is at present the superintendent of the works of the C. W. Hunt Company.

Mr. Hunt joined the Mechanical Engineers in 1885; he was vice-president of the society for two years, and for several years chairman of the Committee of Publication. Mr. Hunt is a member of a large number of other societies of a technical and scientific nature, and holds official positions in some of them. He is a member of American Institute of Mining Engineers; of the New York Electrical Society; of the Engineers' Club of New York; president of the Staten Island Chamber of Commerce; member Chamber of Commerce of New York, and member Natural Science Association. Mr. Hunt has only recently returned from Europe, where quite an extensive demand is arising for his special line of machinery, and a great many installations have already been made.

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It is claimed for the Kaiser William der Grosse that she made the highest record for a day's sailing during a recent trip, though the trip itself was not a record-breaker. Some time ago Geo. B. Grant threw a decided cloud over these daily-run records, and it seems obvious that about the only records which can be depended upon are those which are possible of verification by persons who can observe the time of leaving of the vessel at one side and the time of arrival at the other. There is a great deal of gambling in connection with these daily runs, and nothing can be depended upon which is made a subject of gambling.

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A meeting of the National Association of Manufacturers will be held at the Waldorf-Astoria, in this city, January 25, 26 and 27. It is expected that about 2,000 members and guests will be present. The committee which has the matter in charge is composed of eighteen members, and at a recent meeting of this committee, Chas. A. Schieren was elected chairman, Augustus G. Paine, treasurer, and Charles E. Locke, secretary.

Eighteenth Annual Meeting of the American Society of Mechanical Engineers.

The regular fall meeting of the A. S. M. E. was held in this city last week, according to the programme, which we have previously published.

Members and their friends to a sufficient number to somewhat crowd the rooms in the society's house, gathered early in the evening of Tuesday, 30th ult., and about 9 P. M. the society was called to order by Secretary F. R. Hutton, who read a letter from Mrs. R. Anna Cary, by which she presented to the society the oil portrait of Robert Fulton painted by himself, and which was loaned to the society about two years ago by her recently deceased husband, Alanson Cary. The gift was received by the assembled members with marked expressions of appreciation and gratefulness.

Following some formal announcements, President Worcester R. Warner presented the annual presidential address on the subject of telescopes. Mr. Warner treated his subject historically and practically, treating the various steps in the development of astronomical telescopes and their effects upon the science of astronomy, and leading up to such mighty engines as the Lick and Yerkes instruments, which were constructed by his firm, though, except for the speaker's familiarity with the subject, there was nothing in the address to indicate that fact.

The address was listened to with marked attention and appreciation, and at its close the members occupied themselves with renewing acquaintance and in social rites until late in the evening.

Wednesday Morning Session.

The business session of Wednesday morning opened with the reading of the annual report of the council by the secretary. The first matter of importance taken up in the report was the application for membership by two gentlemen residing in foreign countries (one in China and the other in India), who, while eminently fitted for membership, did not have the acquaintanceship of five members, required by the existing rules, and to meet these and similar cases in future, the council offer the following as

an amendment to Article X of the rules:

"Applications for membership from engineers who are not resident in North America, and who may be so situated as not to be personally known to five members of the society, as required in the foregoing paragraph, may be recommended for ballot by five members of the council, after sufficient evidence has been secured which shall show that, in their opinion, the applicant is worthy of admission to the grade which he seeks."

The report shows the present membership of the society, including the names which have been passed to be balloted for previous to this annual meeting, to be as follows:

Honorary members.....	16
Members	1,365
Associates	119
Junior members.....	323
Total	1,823

The great increase in the demand for the society's "Transactions" from technical school and other libraries, has caused the council to stop the free distribution of the volumes, and to adopt resolutions whereby such libraries will, in future, be required to pay for such volumes at the rate to members—$5 for paper binding, and $6 for permanent binding. In the case of libraries which are now receiving the volumes free, the new regulation does not go into effect until the distribution of the volume for 1900.

Pursuant to the provisions of an agreement entered into between the society and Mr. Oberlin Smith, the society has become the owner, by assignment, of the design patent taken out by Mr. Oberlin Smith for the oval form of the standard decimal gage for measuring and indicating the thickness of metals, sheet and wire, by thousandths of an inch, the number of thousandths being the number of the notch in the edge of the oval gage. It is not the intention of the society to derive any business advantage from the ownership of this patent, but merely to protect the decimal gage from abuse in unauthorized hands. In carrying out this purpose the society has given manufacturer's license to the firm of Pratt & Whitney, of Hartford, Conn., and will be glad to make a similar arrangement, upon request, with other firms of good standing. The charge for thus licensing manufacturers was stated by the secretary to be the nominal sum of one dollar.

The annual report of the Finance Committee stated the accounts for the year to show a total of

Receipts	$28,385.31
Disbursements	28,337.71
Cash on hand.....	$47.60

Of the disbursements, $1,800 was for bonds of the Library Association. It is expected that the entire issue of the bonds will be owned by the society by the time of their maturity. The report of the nominating committee showed the entire committee's ticket to have been elected, the president for the ensuing year being Mr. C. W. Hunt.

The report of Mr. Henning, as the society's delegate to the international conference at Stockholm, on Testing of Materials, gave an account of the proceedings of the conference. Mr. Henning stated that the Germans had already agreed upon standard specifications and methods of test for a great variety of materials, their action having been found to be of great practical utility. National sections of the institute are to be formed, and the preliminary steps for the formation of an American section have been taken. In the discussion Dr. Thurston moved the appointment of a committee by the president to confer and co-operate with the Institute, which motion was carried.

The report of the delegate of the society to the Conference on Standard Electrical Rules was laid over until Thursday morning, on account of the absence of the delegate, Mr. Woodbury.

The report of the Committee on Revision of the 1885 Code, for the conduct of boiler trials, was presented by Mr. Kent.

This is a voluminous report (52 pages) of a committee which has been in existence since 1895. Owing to the impossibility of getting the entire committee together for consultation, the report is submitted by a sub-committee of four members, "subject to revision."

The report is in the shape of a new code, called the Code of 1897, which is substantially the same as the Code of 1885, with such amendments as the experience of the last twelve years has shown to be desirable. Following the practice of the original committee, several appendices by individual members are added, which give their views on various points and describe particular forms of instruments which they have found adapted to the work.

The report received a full discussion, in which many valuable suggestions to the committee were made. Mr. Hale suggested a change in the standard draft suggested by the committee from 3/8 to .4 inch, and suggested the use of the fire side of the tubes in measuring the heating surface instead of the outside surface, as proposed by the committee. He showed a very simple, portable and practicable coal sampler, invented by Mr. H. J. Williams, and discussed points relative to moisture determinations, flue gas sampling and methods of firing. Mr. Rockwood pointed out why boiler testing is so much more unsatisfactory than engine testing, and contended that the limit of reasonable error should be defined by the committee. He had only praise for the report, but considered it scientific rather than practical. The side of the tubes most suitable for measuring for the heating surface was discussed by several others, the general feeling being that while the fire side is most correct, from a scientific standpoint, the outside, whether it be fire or water surface, is best from practical considerations.

The secretary then read a communication from Messrs. Herr, Marshall and Quereau, acting as a joint committee of the American Railway Master Mechanics' Association, and the Master Car Builders' Association, for the settlement of a standard for the thread joining the two halves of pipe union couplings. The lack of a standard for this dimension leads to much trouble and annoyance, and the communication asked this society to appoint a Conference Committee to confer with themselves and settle the matter. On motion, the old committee which settled the pipe-thread standard so successfully was reappointed for the present purpose.

At the conclusion of the business session the reading of the papers of the docket was taken up, the first one being

Reduction in Cost of Steam Power from 1870 to 1897.

BY F. W. DEAN.

This paper was not historical, except in the statement that the most economical steam engine in 1870 used 19 or 20 pounds of steam per horse-power hour, while in the present year some engines are run upon less than 13 pounds, but was rather devoted to a discussion of the means by which the economy has been accomplished. The greatest single step in economy was the introduction of the compound engine. The steps that lowered the steam consumption of compound engines from 16 pounds to 14 were largely the introduction of the cut-off on the low-pressure cylinder and a reheating receiver between the cylinders. The reduction to 13 pounds has been contributed to by various means. Clearance has been reduced; steam pressures and the number of expansions have been increased; the low-pressure cylinder has been made proportionately larger. Most of the extreme cases of economy have been those in which a good vacuum has been maintained. Some remarks upon boilers were given, the internally fired boiler being favored, although the statement was made that "the horizontal tubular boiler is still the standard of the country, and will probably so remain." The most promising field for still greater economy seems to be in the use of highly superheated steam. We have a right to anticipate, in the early future, a steam rate of 10 pounds in the best designed engines.

The reference to the horizontal tubular boiler as the standard of the country, brought Mr. Stirling to his feet, who, at great length, defended the boiler with "horizontal drums and upright bent tubes."

Dr. Thurston discussed reheaters as an element of economy, pointing out that they might be either a source of gain or of loss, depending largely on the load on

the engine and the capacity of the reheater.

Mr. C. W. Hunt thought the data given in the paper were good and useful, but that the opinions expressed were opinions only, and proceeded to vigorously express his lack of approval of some of them.

Boiler Tests: Classification of Data and Plotted Results.

BY WILLIAM WALLACE CHRISTIE.

This paper consisted almost entirely of tables and diagrams with what seemed to be insufficient explanation. The tables represent results of various experiments by Dr. Emery, Professor Carpenter, Dr. Thurston, Messrs. Hale, Whithen, Barras and others, but no means of identification or separation seem to be provided. The diagrams which were stated to be "self explanatory" are understood to embody the same results as the tables.

The discussion on this paper brought out no new points, but served to emphasize the hazy state of existing knowledge relative to the real influence of the factors entering into boiler design.

Wednesday Evening's Reception.

The regular reception was held, as usual at the New York meetings, at Sherry's, It was largely attended, and was as successful as its predecessors. Further account of it is uncalled for here.

Thursday Morning Session.

This session opened with a paper entitled:

Test of Centrifugal Pump and Calibration of Weir at the Bridgeport Pumping Station, Chicago, Ill.

BY R. C. CARPENTER.

Professor Carpenter's paper tells of an official test of a sewage pumping plant for the city of Chicago. The lift was about 6 feet. The Courtright or "undulating" pumps were employed. This pump consists of three rectangular pistons which are so constructed as to have partly a rectilinear and partly an oscillating motion. The reciprocating and tilting movements of the pistons occur alternately, producing a wave-like motion, the effect of which is to propel forward, with considerable force, any water that may enter the pump. A detailed description of the method of testing was given in the paper. The efficiency realized by the "undulating" pumps was somewhat less than shown by the centrifugal pumps which comprised the original installation. The latter part of the paper related to the calibration of weirs, giving values for the coefficients of discharge, the significance of the determinations lying in the magnitude of the experiments. The general result is the determination that the formula of Weisbach fits the experiments more clearly than any other.

In the discussion Dr. Thurston called attention to the importance of the experiments, supplying, as they do, coefficients of discharge for weirs of a magnitude which have often to be used, but regarding which little accurate knowledge exists, in consequence of the fact that opportunities for accurately determining the discharge, and so determining the coefficients for such large weirs, are seldom found. These opportunities presented themselves in this case, and full advantage has been taken of them, and the result should be, in Dr. Thurston's opinion, that the coefficients determined by Professor Carpenter should supplant those now used. Other members expressed similar views of the importance of the experiments, and Mr. Supplee remarked that French experiments by Bazin showed the discrepancy between the coefficients obtained by different experimenters to be due to the free admission, or the lack thereof, of air under the over fall.

The next paper, in the absence of the author, was read by the secretary. It was on

A Water Purifying Plant.

BY HOWARD STILLMAN.

This paper described a water-purifying plant designed by and erected under the direction of the author, at Port Los Angeles, Cal., for the Southern Pacific Railroad Company. The purpose of the plant was the removal of scaling matter from the water, and the process employed was that known as the Clark, or the Porter-Clark process. A chemical solution, varying with the character of the water, is allowed to mingle with the water as it enters the system, and it then enters the bottom of upright settling tanks which have several partial horizontal diaphragms which the water must successively pass. Cream of lime is used in this first process for absorbing the carbonic acid and precipitating the carbonates in solution. Before passing a second similar series of tanks, soda ash is introduced and chalk is deposited in the settling tanks. The water, while not "purified," was converted to a fairly good water for boiler use.

This paper brought out a full and excellent discussion. Mr. Cary, in a written discussion, said that the prevention of scale in boilers had been left altogether too much to quacks. He considered the method described, of treating the water before its entrance into the boiler, superior to the introduction of scaling compounds into the boiler; but, nevertheless, the latter plan has sometimes to be used. He thought the apparatus described insufficiently provided with facilities for cleaning, and thought mechanical stirrers should be added to secure thorough admixture of the chemicals with the water. Mr. Randolph related cases where the boilers had been kept clean by the use of carbonate of soda and systematic blowing, and he considered that plan successful in many cases, and, with water carrying less than 25 grains of solid matter to the gallon, cheaper than treatment in tanks before feeding to the boiler. He also considered many cases of corrosion in boilers to be due to the effect of alternate expansion and contraction, which, by loosening the oxide and so constantly presenting fresh metallic surfaces to the water, favored fresh oxidation or corrosion. Other members attributed corrosion to the presence of free carbonic acid in the water.

Mr. Trump related the experience of the Solvay Process Company in the treatment of water for 12,000 horse-power of Babcock & Wilcox boilers during the past ten years. This company used soda ash in tanks, the water being then put through sand filters to separate the precipitates. The water, after treatment, contains sulphate of soda, which will not form scale, but if allowed to become at all concentrated, will cause foaming. To avoid this the boilers were blown down from time to time to keep the strength of the solution below 3 degrees Baumé. He also described German plans, in which settling tanks were used in place of filters, but considered the latter preferable. His company, before adopting these plans, had bought a large number of boiler compounds and subjected them to chemical analysis, the result being to show the chief ingredient of most of them to be soda ash. He considered chemical analysis of the water necessary for intelligent treatment in all cases.

Mr. S. M. Green spoke of a patent electric purifier placed in the feed pipe, which in his case had produced excellent results, though he knew of no explanation of its action. Mr. Kent used some uncomplimentary language regarding the methods used in exploiting this device, and pronounced it a humbug, the explanation of its apparent success lying in some other change in the management of the boiler at the time of its introduction. Mr. Rockwood considered facts to be stubborn things, and had no doubt of the success of the appliance in many cases. He considered that engineers should be less positive about their theories being sufficient to settle all questions, and thought they should go slow in expressing positive opinions. Dr. Thurston referred to the use of zinc in naval boilers, and said its good results were undoubted. He thought it quite possible that this appliance might act in the same way and be beneficial. Mr. Durfee, "at the risk of being voted a humbug with unanimity by his friend Kent," related a case in which scale had been changed to mud by putting a boiler in an electric circuit—one wire from a battery being attached to the front end of the boiler, and the other wire to the back end. Other members related cases of both success and failure with the electric purifier, one saying that he depended on the reappearance of the scale to show the need of renewing the zinc plates of the purifier. Mr. Hawkins said that boilers

which were periodically allowed to cool down, gave less trouble from scale than those which were constantly kept hot, by reason of the expansion and contraction constantly loosening the scale.

The next paper was on

Multiple Cylinder Steam Engines—Effects of Variation of Proportions and Variable Loads.

BY ROBERT H. THURSTON AND LOUIS L. BRINSMADE.

This paper embodied the results of a series of tests to determine the relative economy of a triple expansion engine, a compound engine with a cylinder ratio of 7 to 1, as advocated by Mr. Rockwood, and a compound of the familiar type with the ratio of 3 to 1, the experimental engine at Sibley College affording facilities for the above combinations. A running discussion of causes and effects accompanied the report. The conclusions arrived at showed an economy in favor of the triple, when compared to the 7 to 1 compound, of over one pound of steam per horse power per hour, and a larger gain by the latter when compared to the compound engine of 3 to 1 ratio. The triple expansion engine has been here shown at its best, while it is possible to still further improve the economy of the 7 to 1 compound by a change in the jackets and a change in the size and distribution of the receiver volumes.

The discussion was opened by Mr. Ball, who thought the paper defective in not stating its conclusions with sufficient clearness for busy men to find them without delving among a mass of figures. He also thought some of the conclusions not borne out by the observations.

Mr. Rockwood discussed the effect of drop between the cylinders, and considered that when the gap due to the drop exceeds the gap due to cylinder condensation, the drop becomes a loss, but up to that point it is a gain. He protested against his engine being considered a bastard or abnormal type of machine, and contended that it is of a type by itself, and concluded by referring to two of his engines in one of which shortening the cut-off in the low pressure cylinder improved the economy, while in the other it injured it. Dr. Thurston, in the rejoinder, thought that most of the criticisms on the paper were due to lack of care in reading it, and referred to the performance of the Rockwood engine as "remarkable."

Following this came a paper on

Cast Iron Under Impact.

BY W. J. KEEP.

This paper gave an account of an extensive series of experiments conducted by the author to determine the influence of shock upon cast iron. The trials were so numerous that it was mostly necessary to present the results of them in tabular form, fourteen tables being given. Many points were determined. Striking test bars on the side shortens them, and striking on the end does the same; but tumbling test bars in a tumbler in contact with other castings lengthens them. Removing the surface of a test bar weakens it, but smoothing the surface without removing strengthens the bar. Test bars of gray iron containing least silicon gain most by the process of tumbling. The author was unable to discover any relation between the chemical composition and the gain in strength, except as it affects the roughness or the softness of the surface.

Mr. West presented a written discussion criticising some of the author's conclusions, as well as his use of ½-inch test bars. Mr. Niece thought the material not well digested and that the experiments were too narrow to justify the author's generalizations.

The session was concluded with the reading, by the secretary, of

Notes on Rating Electric Power Plants Upon the Heat Unit Standard.

BY WM. S. ALDRICH.

This paper was supplementary to a paper bearing the same title, presented by the author at the Hartford meeting of the society. The paper discussed briefly the progress shown during the past few years in the economic performance of steam power electric plants, showing that the very low economy of such electric-light and railway stations is not entirely due to uneconomical engines and variable loads, and then presented a few notes upon a further consideration of the heat-unit rating of such plants.

Of this paper there was no discussion.

After luncheon the hall was filled to overflowing to listen to an account, by Mr. Gus C. Henning, of the latest achievements in color photography, which included the exhibition of many of the pictures on the screen by the aid of the lantern.

Thursday Evening Session.

The first paper upon the docket for the evening was

A Strength of Gear Chart.

BY JOHN B. MAYO.

This paper offers a diagram for the solution of problems in gearing of the same general class as those which we have published from time to time by Mr. Hess. It is based on the factors first published in our columns in a communication from Mr. Wilfred Lewis, which have, in fact, become the standard of advanced practice. The author gives additional factors for materials and forms of construction not covered by Mr. Lewis, and the chart is thus made to cover all cases arising in ordinary practice.

Mr. C. L. Griffin offered a written discussion urging that the chart attempted too much and did not leave sufficient latitude for judgment. As an embodiment of his objections, he offered a simple chart of his own for the same purpose.

The second paper was entitled

The Law of Hydraulic Obstruction in Closed Streams.

BY DAVID GUELBAUM.

This paper is a strictly mathematical discussion. The author announced that, after certain investigations, he had discovered a common and very remarkable property, which he entitled as above.

On this there was no discussion.

At this point a resolution of thanks to the New York members for the entertainment provided was interjected into the program, and after appropriate remarks by Messrs. Oberlin Smith, Ashworth and Woodbury, was passed with enthusiasm.

Following this the report of the committee for the revision of the code for boiler trials was taken up again, because of the presence of the chairman, Dr. Emery, who was absent the previous morning.

The discussion was opened by Mr. Stirling, who wanted more attention given to water tube boilers, especially those with vertical tubes, and was continued by Professor Jacobus, who suggested a method of allowing for the moisture in the coal by finding the equivalent weight of dry coal. Referring to the question of moisture in the steam, he considered that if there was enough to be allowed for at all, it should be taken from the steam and weighed. Mr. Kent referred to a new test for the blackness of the smoke by comparison with a series of standard cards of varying blackness. Mr. Yale reopened the question of the fire versus the outside surface of the tubes, and insisted on the importance of noting the method of firing and the thickness of the fire. He contended that the heat value of the coal could not be determined from the chemical analysis, and that only a calorimeter test should be accepted, to which Mr. Kent replied that, while the formula used in connection with the analysis was undoubtedly theoretically incorrect, extended experiments showed it to be practically reliable. Mr. Whitham considered that the standard draft was not defined clearly enough, and that while too little for anthracite rice coal or culm, it was too large for many bituminous coals. Mr. Cary considered that the setting and furnace should be described and measured, and that the use of the water meter should be barred. He also described a smoke test by the use of standard smoked glasses. Mr. Manning thought a ten-hour boiler test was altogether too much like a measured mile steamship test, and that the duration of the test should be seventy-two hours. Mr. Ashworth thought the tendency was to load the code down with refinements that made it impracticable. He also considered that operative and not ideal condi-

tions should be aimed at. Mr. Hawkins objected to the methods provided for stopping and starting, and thought it introduced errors which were inconsistent in connection with the refinements provided elsewhere. He also thought the length of the test should be extended.

In conclusion, Mr. Emery and Mr. Kent, on behalf of the committee, explained their perplexities, and begged the members to not merely raise objections, but to put their suggestions in definite shape for action.

Following this the session was concluded by the presentation of Mr. Woodbury's report, as the society's delegate to the Conference on Standard Electrical Rules, which was adopted.

The hour being late, it was then voted to adjourn without completing the program for the evening, and to assemble an hour earlier, Friday morning, than the docket provided.

Friday Morning Session.

This session opened promptly at 9:30 o'clock, in accordance with the adjournment of the previous evening, the first paper taken up being

A Boiler Setting.

BY G. W. BISSELL.

This paper, the shortest one presented at the meeting, gave a sketch of a mode adopted by the writer for supporting a horizontal return tubular boiler, providing a three-point support and leaving the boiler and the setting independent of each other. The boiler has four lugs, and suspension rods from a cross I-beam above attach to two of them. At the other end a second I-beam stands above the lower one with a central roller, upon which it is supported. The four ends of the I-beams stand upon uprights of channel iron. The brickwork setting is thus entirely independent of the boiler support.

On this paper there was no discussion, and the proceedings were continued by the reading of

Auxiliary Engines and Transmission of Power on Naval Vessels.

BY GEO. W. DICKIE.

This interesting paper, by the manager of the Union Iron Works, San Francisco, spoke first of the great lack of uniformity in government practice, and of the dividing up of responsibility and control under the different bureaus, so that while either one of the three modes of power transmission here spoken of, hydraulic, pneumatic or electric, could be employed for the entire range of work, it would not be uncommon to find all three systems employed upon the same vessel. The three systems of power transmission with the advantages and the disadvantages of each were clearly and fairly discussed, the writer having had most experience with and perhaps slightly favoring hydraulic transmission. Particular stress, however, was laid upon the desirability of having the men in charge of either system who personally favor that system, in order that it may have a fair chance of success. As the officers are all declared to be much in favor of electric devices, it was argued that they would necessarily be better treated all through. While the writer had personally advocated a hydraulic system, he said that the officers personally would rather sit up all night with an electric plant than spend a moment more than the law required with a water motor.

On this paper there was no discussion and the next to be taken up was

An Accurate Cost-Keeping System.

BY H. M. NORRIS.

This paper presents in detail a method of cost-keeping which the author has just put into use with satisfactory results. Its leading feature is the charging of the tool cost and expense account against the work as a certain amount per hour added to the wages of the operator. The author condemns the method of lumping all costs—wages and expense—under an average charge per hour to cover both, and also condemns the charging of the expense item as a percentage of wages.

The paper shows the various blank forms, and is a fairly complete account of a system in actual use.

Considerable discussion followed the reading of this paper, the opinion of many being that the tendency in these matters is toward over refinement, especially in view of the fact that real accuracy is impracticable, and that, only substantially accurate results being possible, over elaboration accomplished nothing in the end. Mr. Halsey contended that the practice of including office expenses as an item of cost was wrong in principle, and that in cases where large stocks are carried it had the result of inflating the assets by including them in the inventory value of the goods on hand. He contended that the cost of production stopped at the shop door, and that all outside of that should be considered as forming part of the cost of distribution. He also claimed that methods in vogue for accounting for non-productive labor and heavy tool charges were inaccurate, and were largely responsible for the usual discrepancy between estimated and actual profits. Mr. Rodgers agreed with these views regarding office charges, and pointed out some additional sources of discrepancy between estimated and actual profits. Mr. Randolph explained his method of determining the non-productive labor, which was to simply subtract the useful labor from the total. Mr. Hunt recommended the members to read an English book on this subject by Mr. J. Slater Lewis, which discussed all these problems fully and offered a complete and practical system fully developed ready for use. This system is in use at Mr. Hunt's works, where the product is very varied, and he finds it eminently satisfactory.

Following this came

Thermodynamics Without the Calculus.

BY GEORGE RICHMOND.

This paper was prepared by Mr. Richmond in consequence of a resolution requesting him to do so, which was passed at the Hartford meeting of last spring. He explained that he thought an elemenary treatise on thermodynamics would hardly comport with the dignity of the society's transactions, and he had therefore prepared his paper more as a report showing the "state of the art" at the present time.

The paper is an admirable one, and presents by diagrams the leading conceptions of the science, and especially aims to make the meaning of the term entropy tangible, which it scarcely is when presented as a mathematical expression. The paper is an admirable illustration of the manner in which the treatment of abstruse questions progresses from the involved to the simple, precisely as inventions usually progress from the complicated to the simple, the simpler form representing the last and highest merit of invention.

The paper was received with hearty applause and expressions of high appreciation were made. Several members thought that Mr. Richmond had been unduly careful of the dignity of the society.

The Valuation of Textile Manufacturing Property.

BY CHARLES T. MAIN.

This paper embraced a quite complete statement of the considerations that should have weight in determining the value of a factory plant. The market value, or the sum which one party who has the money and wants to buy should pay for a plant, the owner being willing but not forced to sell, was first considered, and the various particulars bearing upon it were enumerated. Then valuation for bonding or raising money, valuation for rental, for taxes, for insurance and adjustment of fire losses, for purposes of condemnation, were severally considered.

Mr. Rockwood suggested a difficult case of appraisement, that of estimating the value of machinery in a mill which is condemned and to be removed to make way for public improvements, and then spoke of the varying personal equation in appraisers. He would rather favor a time rate for computing depreciation.

Mr. Woodbury spoke of the depreciation of machinery by the continual development of improvements. He mentioned a Corliss engine, one year old, appraised at 95 per cent. of its first cost, when Mr. Corliss said that the improvements developed in that year would show a much greater difference in the values of engines only one year apart.

A Screw Die for the Turret Lathe. A Staybolt Threading Device.

BY JAMES HARTNESS, SPRINGFIELD, VT.

The first of these papers presents the opening die head, which was published

in our issue of January 2, 1896. The most striking peculiarity of the apparatus lies in the method of making the chasers, and the surprising resulting accuracy of the threads cut by them. We expect to have more to say about this in the near future.

The second paper relates to an application of the above mentioned die head in pairs, to the manufacture of locomotive staybolts, whereby that operation is reduced to a simple turret lathe basis, with corresponding speed of work. The two ends of the bolt are threaded simultaneously, and means are provided whereby the threads at the two ends are true continuations of one another, or, in case it is so desired, the dies may be adjusted to match the errors of existing staybolt taps, and so be made to produce bolts which accurately reproduce the tap threads and fit the holes tapped by them.

These papers elicited no discussion. A finely made die was exhibited in connection with the reading.

A Convenient Form of Wire-Testing Machine.

BY ARTHUR L. RICE.

The paper describes, with suitable illustrations, a small testing machine devised by the author, for wire and other small specimens. It is primarily for tests of tensile strength. The pull is applied by a screw and hand wheel, and the readings are taken from a spring balance and dial. An air dash-pot is used to avoid the rebound of the balance. The machine is also used for bending tests.

No discussion.

Dustless Buildings.

BY C. J. WOODBURY.

This paper, which was short and without needed illustrations, called attention to the prevalence of dust in the modern high office buildings, and proceeded to describe an air filter devised and successfully employed by the author. In a building of nearly 500,000 cubic feet capacity, from half a peck to a peck a month of fine dust was taken from the filter bags, and tests of the air before and after showed a great improvement in the purity of the air.

In reply to questions, the author stated that the material collected in the bags showed, by chemical and microscopical analysis, that it was composed of a very great variety of material. The fly line, spoken of in the paper, was at about the sixth or seventh story. Mr. Henning, who has a nineteenth-story office, said that when, occasionally, in the summer, a fly was brought up by the elevator, it would, if it could, find a window at once, fly out, and plunge downward to its normal level of activity.

The Stevens Valve Gear for Marine Engines.

BY ANDREW FLETCHER, HOBOKEN, N. J.

This paper is largely historical, and is intended to place on record an account of the origin and use of a widely used construction which has received inadequate attention in print. The author of the paper, as a representative of the N. & A. Fletcher Co., formerly Fletcher, Harrison & Co., has been associated with the Stevens gear for a period of forty-four years, during which time over two hundred steamers have by them been fitted with it.

The paper contains two letters by Mr. Francis B. Stevens, who invented the gear in 1839 and applied it in 1840, and who, though of the venerable age of eighty-seven years, is still an enthusiast on all subjects connected with steam navigation. The letters contain the drawings and claims of the original patent, granted January 25, 1841, and shows the gear in substantially the form used to-day. There is, in fact, probably no construction in steam engine practice that has endured so long as this, and this longevity is a feature of the individual engines as well as of the valve gear. It is a common remark among steamboat men, that the standard American engine as applied to side-wheel boats never wears out, it being no unusual thing for the same engine to be removed from one old hull for use in a second or even a third one. In this connection Mr. Fletcher states that not long since he was upon a steamer in New York harbor for which he had made a new cylinder and front embodying the Stevens gear in 1855, and which remains to-day in good working order.

The paper concludes with drawings of the toes and wipers as applied to the crack steamers New York and Albany, of the Hudson River Day Line.

This paper attracted great interest. It was hoped that Mr. Stevens would have been present, but his great age rendered it inadvisable. Mr. Rockwood spoke of poppet valves and of their successful use upon engines at 125 revolutions per minute. Mr. Pomeroy spoke of an arrangement of the lifters, whereby, when desirable, the steam could be made to follow full stroke. Mr. Kafer said that sharp cut-off was of little importance on steamboat engines, so that the objection to poppet valves on that ground was hardly tenable. Mr. Fletcher, the author of the paper, gave a number of interesting reminiscences of the old river steamboat engines. He spoke of trouble with adjustable cut-offs in the hands of careless engineers, and cited instances where the Sickels cut-off had not been as satisfactory or economical as the Stevens valve gear.

Machine Molding Without Stripping Plates.

BY E. H. MUMFORD.

This paper was devoted to a description of the Tabor molding machine, recently described in our columns, the author of it having been associated with Mr. Tabor in the later development of it. The superiority of the method of machine molding without stripping plates, as employed in the latest Tabor machine, and the saving in cost of patterns and in the work of fitting them, was clearly presented.

There was no discussion of this paper.

Electricity in Cotton Mills.

BY N. B. SMITH WHALEY, COLUMBIA, S. C.

This paper is a comparison of results obtained in two cotton mills of nearly equal size, but one driven from a single engine, through rope and shaft transmission, while the other is driven by separate motors for each main line shaft. The friction horse-power of the shafting in the case of the steam-driven mill was 226, and in the case of the electrically driven mill 149, the difference of 77 horse-power being credited to the electrical system. It should be noted, however, that the power of the steam mill is measured at its origin —the steam cylinder—while the electric mill obtains its current from a central station, its power being measured at the current supplying the motors, and so does not include the loss of the generator or of the prime motor. The author is of opinion that a generator directly connected to an economical type of engine would not more than neutralize the apparent gain.

Apart from the question of power, the author states that the steam mill consumes more supplies in the shape of oil, sizing for ropes and other incidentals, and points out the advantage of being able to operate any section of the electrically driven mill independently of the others.

Mr. Kent argued that the saving claimed in the paper for the electric drive was not due to that cause. He also intimated that the horse-power was not taken on the same basis in the compared cases. Mr. Main also doubted the correctness of the results as stated.

This concluded the reading and discussion of papers. Secretary Hutton announced that the spring meeting of the society would be held at Niagara Falls.

President Warner then, with a few felicitous words of thanks and farewell, declared the meeting adjourned.

The number in attendance, as registered at the close of the meeting, was 608, or more than fifty greater than the year before.

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New Shops of the G. A. Gray Co.

We have a letter from Mr. G. A. Gray, of Cincinnati, in which he says:

"We have closed contract for a new building for machine shop. It is to be situated within city limits, on the main line of the Cincinnati, Hamilton & Dayton Railway, adjoining the foundry which we built about four years ago. The main building will be of brick, 319 feet long, 50 feet wide, three stories high, with annex about midway for elevator, stairway and washrooms. This annex will be shut off from main shop building by means of fireproof doors; also, a one-story erecting shop, with saw-tooth sky-

lights, connecting with main building. This floor will be 4 feet above the railroad side track—or, in other words, on a level with the top of a platform car—for convenience in loading the finished machines for shipment.

"The shop is so situated with relation to the foundry that the heavy castings may be entered at one end and moved along in the same general direction, until they finally arrive on the fitting or erecting floor contiguous to the railroad side track, where the machines will be assembled and belted for testing, then skidded and rolled out on the car for shipment. The whole plant—foundry as well as machine shop—is planned for the manufacture of iron-planing machines, all the tools being arranged to avoid repeated and unnecessary handling.

"We expect to get into the new building by next June."

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The Performance of a Pistol.

Many of our readers will remember our illustration of the Borchardt automatic repeating pistol in our issue of February 14, 1895, and will be interested to know that in a test of this pistol in target firing, at Creedmoor, eight shots were fired with one of them in fifteen seconds by Major N. B. Thurston, at 100 yards, and his score was seven bull's-eyes and one "center," an achievement which, as a whole, is said to be unprecedented.

In our issue of November 18th we published an item designed to show in detail just what takes place when a rifle is fired, and with what incomprehensible rapidity the various actions must take place; but still more wonderful was the performance of this Borchardt pistol when shown to the editor of this journal by its inventor, who, by the way, acquired his mechanical experience mainly in the armories of this country, although he has been for some years connected with Ldw. Loewe & Co., of Berlin. In an upper room of their factory they have a place where a target can be fired at, and there is there a pistol which is modified slightly, so that when the magazine holding eight shots is inserted and the trigger pulled, the magazine is emptied by automatic action. The time in which this is done has been determined by an autographic arrangement consisting of a strip of paper moved by clockwork at a known rate, and the shots fired into it, and it is thus known to be one-third of a second. Within one-eighth of this time, therefore, the firing bolt is advanced, the charge exploded, the bullet forced out of the barrel, the shell extracted from the breech and thrown out, a new cartridge forced up into line with the breech, and then into it, ready for firing. All this must be done within one-eighth of one-third of a second, or one twenty-fourth part of a second.

This particular pistol is fixed to act in this way merely to show that in ordinary use the operator cannot pull the trigger too rapidly for the automatic action of the weapon, its ordinary operation requiring a pressure of the trigger for each discharge.

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Distribution of Wear on Universal Milling Machines.

Nearly all the spiral milling that is done on universal milling machines is right-hand spiral, and if the ordinary indexing is done by turning the index pin in the same direction, the wear will thus be concentrated upon one side of the worm wheel teeth. It follows from this that if, when a particular or special job of indexing is to be done, the index pin is always turned in the opposite direction, use is thus made of the opposite side of the worm wheel teeth which are little, if at all, worn, and consequently retain their original accuracy much longer. This is a point which should be generally observed in handling universal milling machines.

Another point is in respect to the wear of the table slide. Nine-tenths of the work done upon such machines is short, and when spirals are cut, the spiral head must necessarily be at the extreme end of the table. This concentrates the wear of the slide at a certain point somewhat in advance of the spiral head; but if, when plain milling is to be done, the head is slipped forward upon the table, this will bring the wear of the slide in a new place, and by observing this practice the slide will wear much more evenly and remain in satisfactory working condition much longer.

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Foreign News Notes.

An opening is waiting in Bolivia for small factories for the manufacturing of machinery in everyday use.

A concession has been granted to an American company for the construction of a railroad across Bolivia; it also provides for the construction of telegraph and telephone lines.

In Matto Grosso, Bolivia, there is a good demand for firearms of every description, machetes, axes and tools; nearly all on sale are of German origin.

There is an opening for steam pumps of the simplest fashion in Palestine, for irrigation purposes in the orange gardens, of which 450 are located at Jaffa.

The Bolivian Government has granted to Sr. Domingo Costa a concession for the construction of a line of railway from the Pacific port which Chili has granted to that country to Cochabamba, *via* Oruro. The work is to be commenced three months after the plans are approved, and forty-five miles must be thrown open for traffic every year.

Colt rifles and revolvers monopolize the higher-grade market in Ceylon. Cheaper lines are supplied by Germany. Winchester repeating rifles share with those of Belgian manufacture in the Straits Settlements. An American Winchester will bring $23, and a Spencer $11. Our Colt revolvers sell there from $18 to $25 per dozen. These brands also hold their own in Western Australia, where they are preferred for kangaroo hunting.

A. F. TENNILLE.

Washington, D. C.

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Machinery Exhibits in Germany.

Consul Monoghan again calls attention, as he has done so often before since his residence in Germany, to the eagerness with which the Germans are seeking foreign trade by the sending out of well-trained commercial travelers. By this means Germany to-day leads the world in exports to Switzerland.

It follows, just as surely as night follows day, that the only way to secure and retain business is to get out and hustle. One American manufacturer sent machines to Berlin, put them together, and then advertised an exhibition. The result was that sales were made, and the good work has gone on successfully. Another house, much better known than the foregoing, and with a better reputation, sent over machinery to London, where it was put up; they then sent over an English-speaking agent to Germany with English catalogs. He was told that they would *not* buy until the machinery was brought to Berlin and there put in motion.

There is a big field in Berlin for high-class machinery; but exhibitions of the work they are guaranteed to do must be made. This one idea ought to be dinned into the ears of manufacturers, until the folly of sending circulars printed in English, and agents who cannot speak any language but their own, is realized and the practices given up. Berlin is a large city. It is easy of access. Rents are not unreasonably high. Power is almost everywhere obtainable. Exhibitions are always well patronized, especially by parties interested in the subjects. It will pay, and pay well, to exhibit high-class special machines. No exhibition, exposition or fair should be allowed to pass without such expositions of our machines being made. London may be all right for England and her colonies, but Berlin is one hundredfold better, if you want the Germans to buy.

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Death of Thomas Disston.

Thomas Disston, brother of Henry Disston, founder of the saw works of Henry Disston & Sons, died suddenly on November 24th, at Haddonfield, Pa. Mr. Disston was born in Nottingham, England, in 1832, coming to the United States when sixteen years old, and being thereafter connected with his brother's works, and a number of his inventions being used there.

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General Principles in Technical Education.

The article on "Technical Education," by Mr. A. L. Bowen, which was published in our issue of November 25th, contains more than one suggestion which is worth enlarging upon, but nothing of more real value than that the hand-books put out by the various rolling mills should be put into regular use, and the suggestion has far wider scope than was outlined.

The fault of many of the formal treatises is, that they stop just short of the point where their information can be put into immediate use, and they should, in our opinion, be supplemented, as Mr. Bowen suggests, by constant reference to the pocket books and manuals, in order that the basis and origin of the rules and tables of the latter may be made plain, and so prevent their being regarded and used in future as collections of mere rules of thumb. That they will be used in preference to the school text books is certain, and unless this is done, or unless the student in future work works out the connection himself, much of the value of rational study is lost.

It is all very well to say that a man thoroughly grounded in general principles can attack any problem successfully, and that the purpose of education is to teach men to think, and not to merely fill their heads with useful information as a jug is filled with water. All this, in a broad sense, is of course true; but, at the same time, the object of most young men in attending an engineering school is, we think, not so much the development of their minds as the equipment of themselves to earn a livelihood, and there can be no doubt that the course of study should be directed to the latter object, and that the student should be familiarized with the sources of those data and practical formulas which have been put into shape for quick use.

It is a rather discouraging experience for the young engineer to spend a day or two in going back to first principles in the solution of some problem in hydraulics, for example, only to find that some untaught and scornful underling would do the same work in, perhaps, half an hour.

A large amount of the time of most graduate engineers, during their first few years in practical affairs, is devoted, we think, to the developing of short cuts, and the building of bridges between the general principles they have learned and the problems they have to solve, in order to save the perpetual rehearsing of general principles which they otherwise find it necessary to go through. This is largely done after the various subjects are cold, and at heavy expense of time and labor, in place of the trifling amount of both involved in tracing the connection at the time of the original study of the subject.

We are fully persuaded that the spirit of the old so-called liberal education—whose chief purpose is mental discipline—has been allowed to have altogether too much influence in the modern technical education. A modern engineering course cannot be pursued without its effecting the mental discipline, and many strictly technical subjects are just as valuable from that standpoint as those which are lugged in for that purpose alone. The mental discipline is, in other words, a necessary incident of the work, and no special effort need be made in that direction. The feature requiring attention is not, then, in our opinion, the discipline of the mind, but the reduction of general principles to the point where they can be applied to use.

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The "Engineer" and American Railroad Speeds.

The "Engineer," of London does not, we are sure, intend to pose as a "humorous" journal; but, nevertheless, it is sometimes quite amusing, particularly when trying to demonstrate to its own satisfaction, and to make its readers believe, that things regularly done here in America are, as a matter of fact, "impossible, don't you know."

In its issue of September 10th it published the official record of the fast run between Philadelphia and Atlantic City, N. J., for the month of July last, this record showing the time, from start to stop, to average 48 minutes for the 55½ miles—the figures varying slightly on different days. The table was furnished by the Baldwin Locomotive Works, and showed the performance of the train in detail for every day of the month, while accompanying it was a profile of the road, showing the grades traversed. One would imagine such information from such a source to be entitled to acceptance in a respectful manner, and in fact, for the time being, the figures were allowed to go unchallenged, and in its issue of October 22d the "Engineer" even published a letter from Mr. E. K. Clark, of Leeds, testifying that he made the trip on the locomotive of the train on a day when the distance was covered in 47 minutes. In its issue of November 19th, however, the paper returns to the subject in a leading editorial, and, referring to the official record before published, it says: "Beyond all question, that official record is quite fallacious. It is not true either in substance or in fact. It is a record of mechanical impossibilities. Nevertheless, we think we have actually got the scientific truth in Mr. Clement Stretton's letter, which will be found in another page."

Reference to Mr. Stretton's letter, three pages back, shows that it relates to a run made in 1893! when the time made was 55¼ minutes. There is not a scintilla of evidence aginst the record of 1897, but because of the slower time in 1893, the record for the past season "is not true either in substance or in fact"!!

Now the question is: Does the "Engineer" really believe that because a certain rate of speed was not attained in 1893, therefore it cannot be in 1897, and that anyone who claims it can be is mendacious? or does it deliberately intend to resort to mere pettifogging methods to deceive its readers? We must confess that we see no other alternative.

Nevertheless, the "Engineer" is forced to admit from Mr. Stretton's figures of the run as made four years ago, that American locomotives do make faster time than English ones.

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An Official and an Unofficial Test of Armor Plates.

We have previously had something to say regarding the curious circumstance that official tests of armor and of projectiles are almost invariably successful. If a plate is being tested, it withstands the shell and is scarcely injured. The test is therefore "satisfactory," and the fact that the projectile is shattered does not count

against it, because, bless you! projectiles are not being tested. On the other hand, when a projectile is to be tested, it usually pierces the plate as if the latter were made of green cheese, and goes many feet into the earth behind the plate, and is recovered practically uninjured—in fact, almost, if not quite, fit for being used over again. Then this test of the shell is "satisfactory," and the entire failure of the plate to withstand it is not counted against the plate, because, don't you see? plates are not at that time under test.

On November 29th, at the Indian Head Proving Ground, there was a test of an 8-inch plate of armor, representing 500 tons, made by the Carnegie Company, for the turrets of the battleships Kearsarge and Kentucky. Two 8-inch shells—one a Carpenter projectile and the other a Wheeler—were fired at the plate, one at a high and the other at a low velocity. Neither shell penetrated or cracked the plate, but both were partially welded into it. The test was regarded as entirely satisfactory, and ensures the acceptance of the armor.

After this official test of the armor plate, the ordnance officials fired a third projectile at the plate. It was a capped shell, and was fired, in this case, to show the penetrating power of the projectile. The shell, fired at a high velocity, went entirely through the plate, and the result in this case was also considered satisfactory—from the shell point of view. And the two tests, taken together, seem to demonstrate that we make impenetrable armor plates and irresistible projectiles.

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Personal.

Our contributor, Mr. William Pilton, has been appointed chief draftsman at the Niles Tool Works, Hamilton, O.

Chief Engineer J. L. Edwards, U. S. N., has been ordered to the Lancaster, and his unexpired leave of absence is revoked.

Mr. G. K. Garvin, president of the Garvin Machine Company, sailed for Europe, on a three months' business trip, Tuesday, November 30th.

Mr. Jerold Flanagan, chief draftsman of the Hydraulic Machine Company, of Pittsburg, for a number of years, has been appointed general superintendent of the works.

Our contributor, Mr. A. L. De Leeuw, has been placed in general charge of the drawing office of the Niles Tool Works, Hamilton, O., in the capacity of designing engineer.

Mr. Ferd. Jelly, formerly machine foreman of MacIntosh, Hemphill & Co., has been installed as foreman of machine department of the Hydraulic Machine Company, Pittsburg.

Mr. P. M. Serdobin, of St. Petersburg, Russia, is in this country, looking after machinery matters. He represents in Russia the Garvin Machine Company, J. A. Roebling's Sons Company and the Fifield Tool Company.

James Whiteside, who was for a number of years with the Chandler & Price Printing Press Manufacturing Co., of Cleveland, O., has been placed with entire charge of the International Radiator Manufacturing Co.'s works at Buffalo.

Mr. Jno. R. Gilmour, formerly of James Rees & Sons Company, boat builders and general founders and machinists, Pittsburg, has accepted the position of foreman of the foundry department of the Hydraulic Machine Company, of the same city.

We will consider it as a favor if our readers will send in items of news regarding changes of foremen, superintendents or others prominently connected with the machine business. Such items are legitimate news of the trade, and we are glad to make room for them.

Mr. Wm. H. Derbyshire, superintendent of Bement, Miles & Co.'s works, at Philadelphia, Pa., has been made president of a new company chartered in Pennsylvania, to be called the Chambersburg Engineering Company, which will do a general engineering business at Chambersburg, Pa.

John H. Patterson, president of the National Cash Register Company, of Dayton, O., returned recently from an extensive and a very successful trip abroad, and on the 27th ult. was given a reception by his business associates and the employés of the company, of which any man might well be proud.

Mr. W. S. Rogers, who for the past two years has been superintendent of the American Laundry Machinery Works, Cincinnati, resigned his position recently, and will go into a similar line of business for himself in New York city. As a token of the esteem in which Mr. Rogers was held by the firm and employés, he was presented with a handsome easy-chair.

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Inquiries for Machinery.

Those who make, or who may know of the makers of such machinery as is called for below, will oblige us by sending name and address, mentioning the number of the inquiry. We cannot forward catalogs. We have inquiries as follows:

11. For presses and dies, such as are used for the manufacture of decorative floor and wall tiles.

12. The address of makers of large band saws for sawing logs.

13. For solder in coils, like wire, about ⅛ inch in diameter.

14. For makers of patent burrs used in grinding cement.

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It is announced that the Armington & Sims Engine Co., Providence, R. I., will be sold at auction December 29th.

The Patton Motor Car.

The idea embodied in the Heilman locomotive, that of an automobile car with a self-contained prime mover and an electric generating, transmitting and motor system complete, has been worked out also, and quite completely, in the United States. The Patton motor car employs a gasoline engine as a prime mover. This is coupled direct to a generator, and thence the current goes to the motors, storage batteries being employed to equalize the work on the engine. The latest development of this system is a four-wheel car, 16 feet over all, mounted on outside journals. Inside the wheels are special spring bearings supporting a steel frame which carries the engine and other machinery. The engine is a vertical two-cylinder Raymond, running at 300 revolutions, and rated at 25 horse-power. A six-pole 15-kilowatt generator is coupled to one end of the shaft, and an 850-pound fly-wheel is on the other end. There are 100 cells of 200 ampere hour storage capacity. The truck is fitted with two 35 horse-power single-reduction motors. The storage battery is kept continually charged, and is only used in starting from rest or to smooth out many loads of short duration. Seventy-five gallons of water are carried for cooling purposes and 25 gallons of gasoline. The success of the motor is said to be such that it has been sold to a street railway company at Cedar Falls, Iowa, and a second one is being built.

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The "Engineering Magazine" indexes, under the head of "Boiler Tools," the excellent watchmaking article, "Staking and Riveting Tools," by A. H. Cleaves, in our issue of October 21st.

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Secretary John A. Penton, of the American Foundrymen's Association, notifies us that the next meeting of that society will be held in Cincinnati, though the date of the meeting is not yet determined.

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Commercial Review.

NEW YORK, Saturday Evening, Dec. 4.

MACHINISTS' SUPPLIES.

The year is now so nearly at a close that it is time for a retrospect over the season's business. Such a view is a most gratifying one, if the trade of last year be set against it by way of comparison.

People are already beginning to take inventory, and the period we are entering is one in which few orders are usually placed. Consequently, we were expecting, when we investigated the market this week, to meet rather a depressing atmosphere. We were, however, agreeably disappointed. Many of the concerns had been receiving good orders up to the present time, and the business of some seemed to be on the up grade. Although, as a matter of fact, there may be no especial

alteration in conditions, the buoyancy of the market impressed us more than it has often done in the past. It is true that symptoms of the lull which is to be expected between now and the middle of January were here and there apparent; but in this there is nothing which indicates weakness in undertone, and it appears that we are to begin a new year with the machinists' supply trade generally firm in sentiment and maintaining a footing a great deal higher than that upon which 1897 made its début.

A member of one of the chief supply firms in this city remarks: "October was the second best month we have ever experienced, and I think November fully held its own."

The representative of one of the chief emery wheel companies represented in this market considers the demand and outlook a subject for congratulation. Not only are they doing well themselves, but they are informed that one of the largest emery mines in the country experienced during November the best month in the history of the business. It is complained by our informants that makers of inferior wheels cut prices and replace those of higher grade by their own. When the latter prove unsatisfactory, the users want to put back wheels of the old make at the price of the inferior.

A general supply and small tool company in this city inform us that during about a week past they have sold a better value of small machines, such as lathes, foot presses and upright drills, than during any previous whole month this year.

EXPORTS.

A wood pulley company who are devoting themselves ambitiously to the export trade, tell us that they are meeting with success, and that the best field is Great Britain. The engineers' strike does not worry them. They say that freight rates across the Atlantic are stiffening, owing to the amount of traffic.

A company engaged in the manufacture of twist drills, etc., report good exports. They are just shipping a consignment of drills to Australia.

POWER-TRANSMITTING MACHINERY

has been in excellent demand this season, and the tone of the market is so healthy that one of the larger companies inform us that they are gradually stiffening prices. Another large company report trade pretty steady, though perhaps not quite so active as at one time during the autumn. A third concern, the Geo. V. Cresson Company, have also been having a most satisfactory trade. Among their more recent work is the erection and equipment with shafting, etc., of the Liberty silk mill, in this city; the supply of power-transmitting machinery to the refuse-disposing works at Barren Island, N. Y., and to the Somerset Chemical Works, Bound Brook, N. J. Their export business is excellent, especially with Mexico. During the latter half of this year they have furnished power-transmitting machinery to a silk mill at Puebla, Mex. Another silk mill in Mexico has lately been purchasing materials in this country, and to the latter we have alluded in the past.

THE TREND OF PRICES.

Two of the chief lines in which advances have been made since our last report upon machinists' supplies, are belting and rubber goods.

As a result of the gradual advance in raw material, belting manufacturers have marked up quotations to an amount which reaches 25 per cent. on paper, in some cases at least, but would not average as high as that in actual transactions. The changes, as quoted for us by one supply dealer, are as follows: On the best grade, from 66⅔ & 2½ per cent., the former price, to 60 & 5 per cent.; on a standard grade, from 75 & 5 per cent. to 70 & 10 per cent.

We hear the complaint made, that when an article is about to advance, dealers stock up their customers with it at the old prices. The complainant considers this unjust to other dealers.

At a meeting of the Mechanical Rubber Manufacturers' Association, it was agreed, as a result of the high prices of crude rubber and other ingredients, to advance the price of all special and listed rubber goods, including cotton hose, at least 10 per cent.

The Brown & Sharpe Manufacturing Company advise us that, on issuing a new edition of their catalog, they will reduce the list prices of certain of their standard and beveled steel straight-edges and hardened cast steel try squares. The reductions are not uniform, but range about 15 per cent. for the smaller sizes, and somewhat less for the larger.

In these days of advancing prices, it is singular that no strength is borrowed from the market by twist drills. If the assumption of a conservative stand by manufacturers is ever justifiable, it would seem to be so in this case. Business is nearly in the state where every quotation, like a tub, stands on its own bottom, and where each jobber outdoes the next one in adding to the discounts. Customers must not, however, suppose that every low price they hear of means a concession to be forthcoming from the conservative house with which they deal.

Bids on a contract for twist drills for naval supplies have just been opened at Washington. There were sixteen bidders, although the number of manufacturers in this country is only about six. From advance sheets of the "Government Advertiser," we learn that the two highest bids were as follows: $290.96, $236.07. The two lowest were: $182.99, $182.38. This is a tremendous difference. It is notable that the higher bids were by two of the largest—perhaps we may say the two largest—supply houses in New York city, who certainly would not be expected to send in estimates just for the fun of the thing. Most of the bids were nearer the lower figures than the higher ones.

It is not impossible that some of the quotations were made inadvertently, which is a matter of not infrequent occurrence. A dealer not in the present contest tells us that once he bid on an order for two screw plates at the rate of $36 each, by mistake for $62 apiece. When he discovered his error, he felt sure that he would lose money, but, lo and behold! a competitor underbid him by $100 (figuratively speaking, we presume), and secured the order. The remarkable part of it was that the latter party had also been doing some careless estimating, and came to him afterward, offering to buy the tools from him at the figure he had named, in order to fill the contract.

THE KLONDYKE.

Already the machinery trade is being benefited by the Alaskan gold discoveries. A cable-way is to be constructed for the transportation of freight over the Chilkoot pass; some of the machinery for which is building at the Trenton Iron Works. A 30 horse-power boiler, to be used in connection with the same, has already been shipped by the New York Steam Power Company.

Orders for a number of steel stern wheel boats to ply upon the Yukon River have been booked by the James Rees & Sons Company, Pittsburg. The same firm has also contracted to build several such boats for the South American trade.

ADDITIONAL NOTES.

The Diamond Machine Company, Providence, R. I., report an increase in their business, with a good volume of foreign orders. They have made several large shipments of their ball case grinder to Austria and Germany recently, and are at work on an order for surface grinders for England. Their universal grinder is finding a large sale, both in this country and abroad.

A favorable report comes from Pittsburg. The Hydraulic Machinery Company has recently received contracts which will keep them busy for some time to come. The machinery orders include hydraulic plate and bloom shears, electric pit furnace cranes, etc.

Quotations.

NEW YORK, Monday, December 6.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 75 @ $12 00
No. 2 foundry, Northern	11 25 @ 11 50
No. 2 plain, Northern	10 75 @ 11 00
Gray forge, Northern	10 25 @ 10 50
No. 1 foundry, Southern	11 00 @ 11 25
No. 2 foundry, Southern	10 50 @ 10 75
No. 3 foundry, Southern	10 25 @ 10 50
No. 1 soft, Southern	11 00 @ 11 25
No. 2 soft, Southern	10 75 @ 11 00
Foundry forge, Southern	10 00 @ 10 25

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.05 @ 1.10c.; refined, 1.15 @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some grades perhaps a little

less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel — Ordinary brands, from store, in small lots, 1.50c.

Cold Rolled Steel Shafting—Base sizes, from store, in small lots, 2.30 @ 2.40c.

Copper—Carload lots, Lake Superior ingot, 10⅞ @ 11c.; electrolytic, 10¾ @ 10⅞c.; casting copper, 10⅝ @ 10¾c. for ordinary brands.

Pig Lead—Carload lots, 3.75 @ 3.80c., f. o b., New York.

Pig Tin—For 5 and 10-ton lots, 13.70 @ 13.85c., f. o. b.

Spelter — Carload lots, 4.05 @ 4.15c., New York delivery.

Antimony—From 7¼ @ 8¼c., according to brand and quantity.

Lard Oil—Prime city, present make, commercial quality, in wholesale lots, 37 @ 38c.

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Manufactures.

Sauppee and Klee, of Reading, Pa., are to erect a new factory.

The City Roller Mills, of Bowie, Tex., were recently destroyed by fire.

The Skabcura Dip Company, of St. Louis, Mo., is to erect a factory.

At Linden, Ind., ground has been broken for the new cellulose factory.

At Manset, Me., A. E. Farnsworth is to have a new factory built shortly.

At Allentown, Pa., Kern & Bro. will erect another story to their planing mill.

At West Chester, Pa., an addition is to be made to the P. M. Sharpless foundry.

At Deckertown, N. Y., Messrs. Toner & Prescott's silk mill is to have an addition.

The steel plant of the Colorado Fuel & Iron Company, at Denver, Col., is to be enlarged.

The Keystone Brewing Company, of Denmore, Pa., is to erect an addition to its plant.

The Standard Steel Works, at Burnham, Pa., are to build a machine shop, 100 x 70 feet.

The Reading Crane & Hoist Company is to erect a new factory building at Philadelphia, Pa.

The firm of Schultze, Thuman & Co., Evansville, Ind., is building an addition to its factory.

The Union Iron & Steel Company, of Youngstown, O., is to add a continuous mill to its plant.

The Oakland Worsted Company, Mapleville, Mass., will in the near future add an electric plant.

The Chicago, Rock Island & Pacific Railroad Company is to erect a machine shop at Chicago, Ill.

At Springfield, O., the Superior Drill Company will build in the spring an addition, 40 x 150 feet.

The Zenith Iron Company, of Ely, Minn., is contemplating the erection of several new buildings.

The Will R. Knox Machinery Company, of St. Louis, Mo., expect to install new machine tools shortly.

The Kent Manufacturing Company is to erect at Tomorden, Pa., an additional mill, 50 x 200 feet.

The Schenectady (N. Y.) Locomotive Works is to have a new building added, which will be 76 x 280 feet.

The firm of Beggs & Cobb, of Winchester, Mass., is to erect a new shop, 150 x 50 feet and four stories high.

At Roxborough, Philadelphia, Pa., Mr. Worthy is to erect an addition to his engine and boiler house.

It is expected that the Ferguson Tinplate Company, of Pittsburg, will build a factory at Uniontown, Pa.

The G. A. Gray Company, Cincinnati, O., is to erect a new machine shop, 50 x 300 feet, three stories high.

The St. Louis, Peoria & Northern Railroad Company has commenced the erection of new shops at Springfield, Ill.

The Florresville (Tex.) Grist Mill Company has decided to establish a machine shop in connection with their mill.

The Buckeye Foundry Company, of Cincinnati, O., has commenced work on the foundation for a new machine shop.

Mossberg & Granville Manufacturing Company, of Providence, R. I., has opened a store at 126 Liberty street, New York.

The American Steel Casting Company's plant, near Sharon, Pa., will be completely modernized, at a cost of $200,000.

The Putnam Machine Tool Company, of

(Continued on page 36.)

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Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Ct.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.

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Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday Morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

Practical foundry man wants position, foreman; (17) years exp.; best refs. Box 111, AMER. MACH.

First-class mech. draftsman wants to change position; A1 references. Address Box 110, AM MACH.

Position wanted by designer of automatic and general machinery. Has had wide experience and good salary. Address Box 113, AMERICAN MACH.

A foreman for 20 years in the drop forge and case hardening bus.; can furnish excellent refs as regards handling help; age 43. Box 114, AMER. MACH.

First class draftsman and mechl. engineer; 20 years varied exp.; designer of high grade eng., etc.; open for eng. Address Box 10, Painted Post, N. Y

Wanted position as foundry foreman by competent and experienced foundryman; engine, machinery or jobbing. Box 109, AMERICAN MACHINIST.

By practical machinist and draftsman, position as foreman or supt. of machine shop; exp. on engines, pumps, air compressors, etc. Box 92, AMER. MACH.

Erecting engineer, long experience on high speed and similar installation, desires to accompany consignment of machinery to a foreign port; references. Box No. 275, Greenwich, Conn.

Position as draftsman or foreman small shop, by 1st class draftsman and practical machinist of 11 years exp. on gas and steam engines, boilers, tools and general machinery. Box 112, AMER. MACH.

Tech. grad. (25 years old) wishes position in any mechanical line, out or indoor work. Neat, rapid, reliable draughtsman; 9 yrs exp. on engines, boilers, tools, printing and gen. mchy; good ref.; New York or Brooklyn preferred. Address Box 106, AM. MACH.

Mechanical engineer, with extensive experience as superintendent and manager of large machine works, is open to engagement. Stationary and marine engines, boilers, foundry work, gearing and general machinery. Can manage shops, engineering department, estimate or solicit. Best of references. Address Box 82, AMERICAN MACHINIST.

Help Wanted.

Wanted—Foreman boilermaker; must be up to date in all its branches, including sheet iron work. Address Atlanta Machine Works, Atlanta, Ga.

Foreman boiler maker for shop mfg marine and stationary boilers and tank work. Must be first class and capable of handling men to best advantage. Address, stating experience, to Box 108, AM. MACH.

Wanted—Foreman blacksmith in large mch. shop; one that has had experience with trip hammers and general blacksmithing; state age and experience. Address reply to Box 104, AMER. MACHINIST.

Wanted—A practical, up to date foreman for a factory manufacturing a specialty. One capable of getting up jigs and devices for getting out work cheaply and handling men to advantage and on piece work. Address Box 107, AMERICAN MACHINIST.

Wanted—For a machine tool works in England, several first-class machinists used to assembling plain and automatic screw machines, etc., of the best class. A splendid opening for really first-class men at good pay and permanent jobs if suitable. No dispute of any kind. Reply giving full particulars of exp., age, salary. Box 105, AM. MACH.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d h'd lathes & planers. S. M. York, Clev'd, O

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Dies & Die Mak'g, $1. J. L. Lucas, Providence, R. I

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Bush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Boye, Cincinnati, O.

We make a specialty of Shartle's patent safety set collars. Prices low and samples free. Middletown Machine Co., Middletown, Ohio.

Wanted—To manufr. for respons. parties sheet metal stampgs., ptns., models, dies for metal, leather, cloth or paper. Bell Elec. Co., 46 E. 14th St., New York.

Lathes, planers, drills, milling machines, vises, also brass working machinery second-hand; must be modern and in first-class condition. C. C. Wormer Machinery Co., Detroit, Mich.

Manufacturers can secure the services of a first class hustler to rep. them in New York export trade exclusively. Large acq. both in New York and all foreign countries. Best of references. For further particulars address "Phoenix," care of AM. MACH.

Manufacturers—A gentleman having a large acq. among export houses at home and abroad desires to secure agencies to rep. mfrs. with office in London, Eng., covering the principal cities in Europe. Best refs, both commercial and banking Those interested will please add. "Malbrowd," care AM. MACH.

For Sale—One engine lathe, 20" swing by 8' bed, G. A. Gray make, $170; 1 lathe, 14" swing by 6' bed, Lodge & Davis make, $100; 1 horizontal boring mill, bores from 4" to 20" cylinder, Barnett Vise & Tool Co. makers; 1 extra heavy vertical boring mill, has 3 separate cutter bars, each has independent automatic feed, weight 15,000 pounds, price $600. Box 91, AMERICAN MACHINIST.

JUST PUBLISHED.

GAS, GASOLINE AND OIL ENGINES

By GARDINER D. HISCOX, M. E.

The only American book on an interesting subject. 279 large pages, 8vo, illustrated with 206 handsome engravings. **$2.50** prepaid to any address.

Full of general information about the new and popular motive power, its economy and ease of management. Also chapters on Horseless Vehicles, Electric Lighting, Marine Propulsion, etc.

SPECIAL CHAPTERS ON

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☞ Our large general Catalogue of books, on every practical subject, mailed free to any address.

NORMAN W. HENLEY & CO.,
15 Beekman Street, New York.

RUE "Unique" INJECTOR
Mfg. Co., PHILA., PA.

MUST BE SOLD.

The United Machine Co.'s Plant and Machinery for manufacturing Printing Presses, Paper Cutters, and all kinds of tools and machinery for Watchcase Makers, Silversmiths, Jewelers, etc. New modern plant built in 1894. Ground 200 x 200, fronting upon three streets in Newark, N. J. Main building, brick and stone, 190 x 60, with all modern improvements for light, heat and ventilation. There are several other buildings. The machinery is in perfect order, set in place ready for use, consisting of over fifty large machines, such as Lathes, Planers, Shapers, Gear Cutters, etc., etc., sufficient to work 75 men. A full set of tools and patterns for the goods the company manufacture. The plant is running, and may be examined any day. **A great bargain for quick buyer.**

JOHN M. GWINNELL, Receiver,
50 Mechanic St., Newark, N. J.

(*Continued from page 35.*)

Portland, Pa., which was recently incorporated, will install new machinery.

The Standard Steel Works, of Burnham, Pa., are contemplating the erection of a machine shop extension of 95 x 67 feet.

Mr. J. R. Brower and Mr. Frank White, Belleville, Ont., intend to erect a new factory. The building will be 90 x 35 feet, and of brick.

Owing to increased business, Mr. P. B. Clark, machinist, Rumford Falls, Me., has selected a new site, and intends to erect a shop.

The Thomas Brass & Iron Works, of Waukegan, Ill., is to erect an addition, 200 x 60 feet, which will be used solely as a brass foundry.

At Clinton, Mass., C. S. Giffin, Charles Frayer and James Connell, all of Clinton, are interested in a new factory to be erected at that place.

The Kester Manufacturing Company, of Raleigh, N. C., has been incorporated, and will engage in the manufacture and repair of machinery.

The Southern Iron & Steel Company has been organized at Birmingham, Ala., to engage in a general foundry business, and will erect a plant.

The Sewalt Combination Saw Tool Company, of New York City, has been incorporated. Directors: R. Ladew, J. H. Ladew and Isaac L. H. Merikle.

At Cincinnati, O., the Barnett Carriage Company has been organized. The incorporators are Clifford L. Barnett, Ed. H. Arnold and David S. Barnett.

The Grand Rapids (Mich.) Brewing Company will make an important addition to its extensive plant on East Bridge and North Ionia streets next spring.

The Keater Manufacturing Company, of Middle Fork, N. C., has been incorporated to make machinery and do casting. Winston men are the incorporators.

The Kalamazoo (Mich.) Foundry & Machine Company will begin at once the erection of a two-story brick shop to replace the one which was recently damaged by fire.

At Vulcanite, N. J., the Vulcanite Cement Company is to erect three buildings, one of which will be 315 x 82 feet, the second 95 x 15 feet, and the third 62 x 42 feet.

Brower & Love, proprietors of the cotton mill at Indianapolis, Ind., are constructing an addition to the plant. The building will be 130 x 100 feet, and will be three stories high.

The controlling interest in the Walker Company, of Cleveland, O., has been purchased by ex-Governor Flower, J. W. Hinkley, Anthony N. Brady and Perry Belmont, of New York.

The Schuylkill Valley Steel Company has been offered a site at Birdsboro, Pa., for the erection of a plant for the manufacture of a high-grade steel. The offer will probably be accepted.

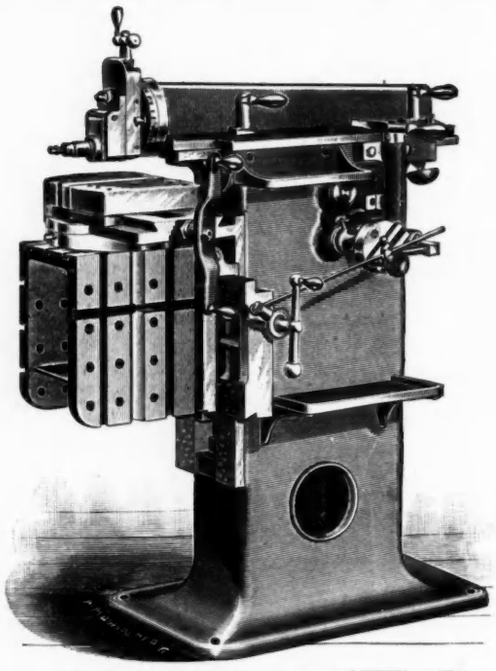
The Pennsylvania Sugar Refining Company, of Shackamaxon Street Wharf, Philadelphia, Pa., contemplate erecting an addition to their present plant by building a brick and iron six-story building.

At Birdshow, Pa., the Schuylkill Valley Steel Company is to locate its plant. Charles James, of Philadelphia, is interested. Mr. James has been for the past seven years with Henry Disston's Sons.

The Marcy Manufacturing Company, of Ashland, Ind., have become owners of a building formerly occupied by the North Furniture Company, and will manufacture iron pumps, steel wind mills and tanks.

The Bunn Cigar Rolling Machine Company, of Binghamton, N. Y., has been incorporated.

(*Continued on page 37.*)



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Latest Improvements.
Useful Attachments.
Strong and Powerful.

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Die Work, Tool Room or General Shop Work.

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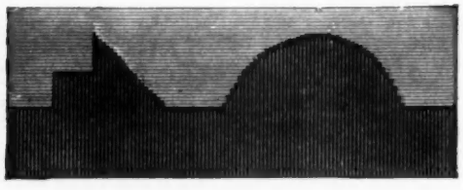
The stroke can be adjusted for curves with machine in motion. The stroke can be adjusted for angles with machine in motion. The stroke can be adjusted for irregular work with machine in motion. It has adjustable table for planing taper work; table can be removed for fastening work to apron. Has a strong graduated swivel vise. Quick work, rapid changes, modern ideas.



This cut shows how stroke can be adjusted with machine in motion by micrometer; adjustment fine and delicate. SEND FOR CIRCULAR.

▲▲▲▲

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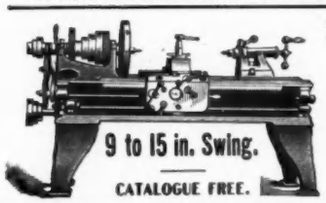

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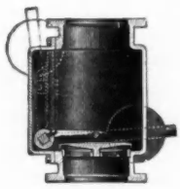

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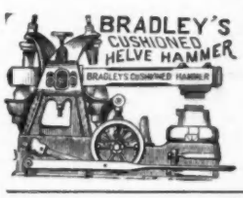

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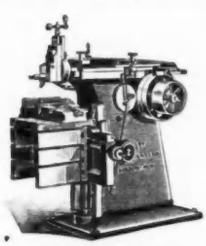

26" GEARED SHAPER.

with the following original features: Projection of support for ram over the table. Angle-plate fastened to platen by a solid lock, giving rigidity and accuracy. Automatic down and angular feed, and special attachments if desired.

Geared Shapers, 22", 26", 30", 34" and 48" stroke.

Crank Shapers, 14", 16", 18" and 22" stroke.

English Agents, BUCK & HICKMAN, London.

GEO. D. WALCOTT & SON, Jackson, Mich.

(Continued from page 36.)

The directors for the first year are Fred Grummond, John Hull, Jr., Robert K. Ackerman, E. L. Rose and John Bunn, all of Binghamton.

In a recent issue we stated that Messrs. Gardner & Drysdale had leased the old shops of the Webster & Pitt Foundry at Louisville, Ky. We wish to correct this by saying that these shops are located at New Albany, Ind., not Louisville.

The Defiance Carriage Company is being organized at Defiance, O., and will build a factory for the manufacture of carriages, buggies and other vehicles. The promoters of the new scheme are Robert Morrison and John Roedel, of Defiance, O.

The Gates Iron Works, Chicago, Ill., is making a large addition to its plant at Stein and Redfield streets, on the line of the Northwestern Road. S. S. Beman has made the plans for a building 300 x 80 feet, of brick and stone, which is to cost $50,000.

Messrs. De Fries & Co., of Berlin and Dusseldorf, Germany, have established a branch store at Vienna, Austria. They will sell exclusively machine tools manufactured by the Davis & Egan Machine Tool Company, of Cincinnati, O. The store will be in charge of Mr. F. H. Reime.

The Lake Erie Railroad Company has plans for a new addition to the shops at McKee Rocks, Pa. The building contemplated is for a paint shop, varnish department and upholstering room. The building will be 70 x 200 feet, built of iron, and is to be lighted by electricity and heated by steam and equipped with all modern improvements.

A new machine tool factory building is being erected by Dietz, Schumacher & Boye at Queen City avenue and Buck street, Cincinnati, O. The building will be of stone and brick, facing 90 feet on Buck street and 180 feet on Queen City avenue, and will be lighted by electricity and fitted with the latest devices in the way of electric cranes and elevators.

A cablegram received from London gives much encouragement as to the rebuilding of the Middlesboro (Ala.) Foundry & Machine Works. This would indicate that the London owners have considerable confidence in the enterprise based upon the results achieved before the destruction. At the time of the fire orders for 25,000 tons of castings were on hand.

The Alabama Foundry & Machine Company, composed of Huntsville (Ala.) business men, has bought the Ivens machine plant at New Decatur, and will convert it into a first-class foundry and repair shop. The plant has been idle for several months. W. I. Wellman, S. J. Mayhew, O. B. Patton, J. R. Stevens, C. L. Nolen, Ed. E. Greenleaf and J. B. Harrison are the incorporators of the new company.

The Hatch Storage Battery Company has acquired the property formerly owned and operated by the Steel Edge Stamping Company in Millis, Mass., and will begin at once the manufacture of electrical appliances. This plant was erected in 1890 at a cost of $150,000, and was the chief industry of the place; but during the subsequent financial embarrassments surrounding the Millis estate, this property was also involved, and it has lain idle for several years.

▲ ▲ ▲

New Catalogs.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9"x12", 6"x9" and 3½"x6". We recommend the 6"x9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

The Bristol Company, Waterbury, Conn., sends us catalog No. 2 of recording instruments for pressure, temperature and electricity. The catalog is 9 x 11 inches.

The Link-Belt Machine Company, Chicago, sends us a catalog of coal shaking screens;

also machinery for coal washing and classifying. The catalog is standard size, 6 x 9 inches.

William H. Haskell Company, Pawtucket, R. I., sends us 1898 catalog of bolts and nuts, screws, washers, chains, etc. The catalog is bound in cloth, contains 150 pages and is standard size, 6 x 9 inches.

M. T. Davidson, of Brooklyn, N. Y., sends us a circular illustrating and describing White's water-cooling tower, he having made arrangements whereby he will control the building and selling of this apparatus.

The Taunton Locomotive Manufacturing Company, of Taunton, Mass., sends us Catalog D of the Wainwright appliances, including feed-water heaters, surface condensers and expansion joints. The catalog is 8 x 10 inches.

The Fellows Gear Shaper Company, Springfield, Vt., has sent us a circular calling attention to its automatic gear shaper. A brief description of the machine is given, also some of its novel features. The circular is standard size, 6 x 9 inches.

We have received from the Oswego Machine Works, Oswego, N. Y., catalog devoted to the illustration and description of the Brown & Carver paper cutting machines. These machines can be so constructed as to be operated by electric motors. The catalog is 7 x 9 inches.

The Deane Steam Pump Company, of Holyoke, Mass., has issued a catalog of pumping machinery, in which various styles of pumps are described and illustrated. The catalog contains some useful information for those who have to do with hydraulic machinery, and is 5½ x 8 inches.

The White Manufacturing Company, Syracuse, N. Y., send us a catalog and price list of gasoline and kerosene appliances used by bicycle manufacturers, painters, tool makers, electrical workers, etc., including blow torches, brazers, enameling ovens, etc. The catalog is standard size, 6 x 9 inches.

We have received from the Davis & Egan Machine Tool Company, Cincinnati, O., a small book of 48 pages, containing testimonial letters from those who have used the product of this firm. The book is entitled, "The Proof of the Pudding is in the Eating," and is small standard size, 3½ x 6 inches.

We have received from the Murray Iron Works, Burlington, Ia., catalog No. 29 of ice and refrigerating machines, such as are used in ice factories, meat markets, breweries, etc. These machines are made in various sizes, ranging in capcity from one to one hundred tons. The catalog is 6¾ x 9¾ inches.

We have received from the Level Flow Oiler Company, Akron, O., a copy of their catalog, in which is illustrated and described the Maranville oiler. Various forms of this oiler are shown, which are made in tin, brass or steel, together with prices of same. The catalog is small standard size, 3½ x 6 inches.

James L. Robertson & Sons, New York, send us a catalog, in which the Robertson improved grate bar is described. The details given of this bar are very full, and the catalog should prove of great interest to those who have to do with the operation of furnaces and steam raising generally. The catalog is 5¾ x 9 inches.

The John M. Rogers Boat, Gauge & Drill Works, Gloucester City, N. J., has sent us an advance copy of their catalog. In this are described various kinds of measuring instruments, such as calipering machines, reference disks, caliper gages, etc., also adjustable reamers, mandrels, blade grinders, etc. A list of establishments in which these instruments are used is included and the catalog is 6¼ x 9 inches.

The Jeanesville Iron Works Company, of Jeanesville, Pa., send us a catalog of mine and special pumping machinery. Very minute descriptions of the parts of these pumps are given in the catalog, and at the back of same some useful information is included on the pressure of water, loss by friction, etc., which will interest those who have to do with pumps and pumping machinery. The catalog is standard size, 6 x 9 inches.

The Frank Kneeland Machinery Company, Pittsburg, Pa., has sent us a copy of its catalog of roll turning lathes, shears and punches, some of which they construct direct-connected to engines and electric motors. Illustrations of various kinds of rolling and tin-plate mill machinery are included; also those of completed plants which have been equipped by the company named. The catalog contains sixty-four pages, and is 8¼ x 10 inches.

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WM. B. FRANKLIN, Vice-President.
F. B. ALLEN, Second Vice-President.
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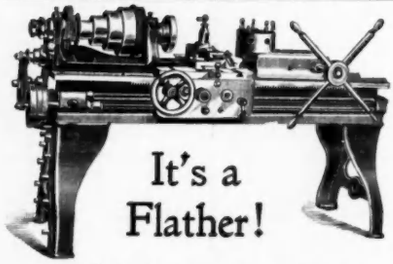

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X That saves making half the cutters, and half the fixtures, must save money.

X The "Duplex" does just that. The cutter arbor can instantly be set vertical, horizontal or any angle between.

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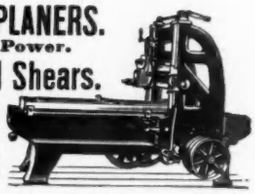

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Special Mach'y Dies,
THE STILES & FLADD PRESS CO.,
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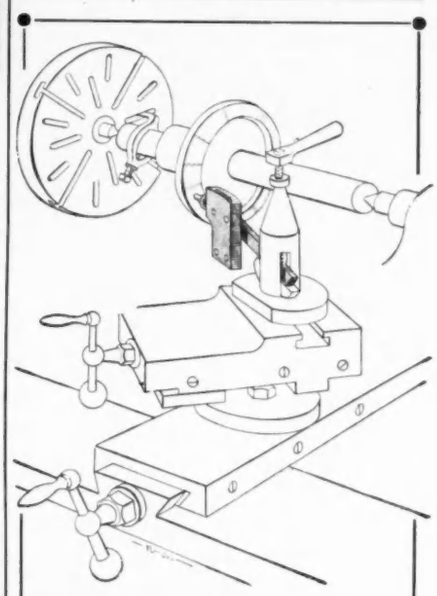

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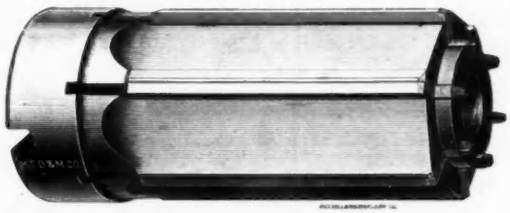

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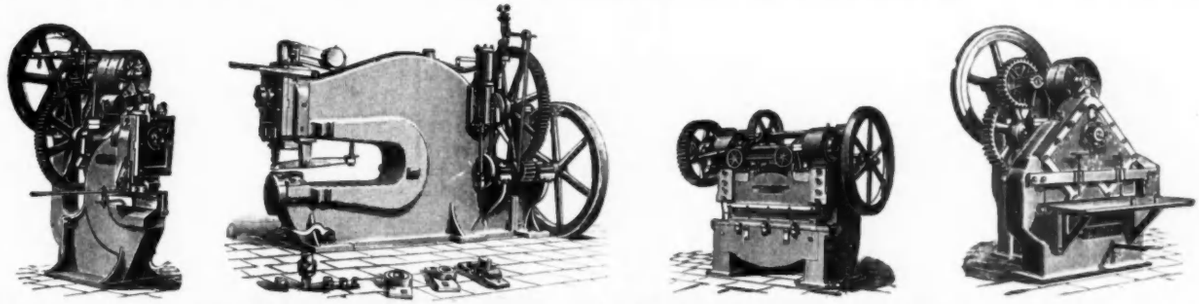

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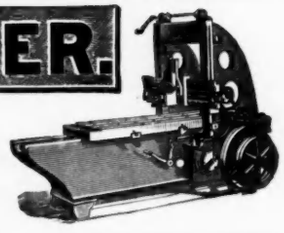

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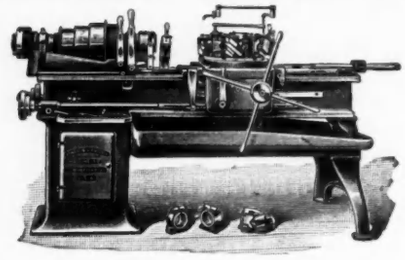

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The No. 1 machine will grind and shape tools with shanks up to 2⅛ inches by 2 inches. The No. 2 will take tools up to 2 inches by 1½ inches. As savers of time and money these machines are unrivaled.

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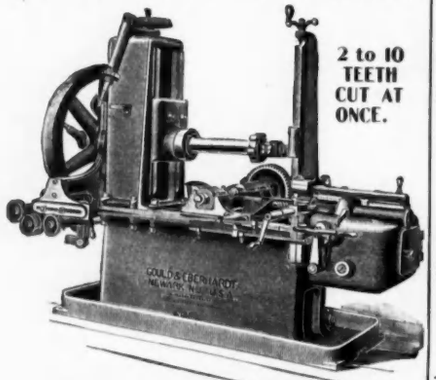

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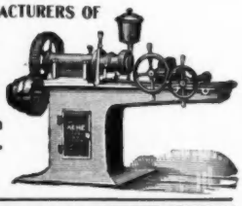

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